From: Stoick, Paul T CIV USN (USA) [/o=Organization/ou=First Administrative Group/cn=Recipients/cn=paul.stoick]
Sent: Monday, April 8, 2019 8:07 AM
To: Robinson, Derek J CIV USN NAVFAC SW SAN CA (USA) [derek.j.robinson1@navy.mil]
CC: Banister, Stephen D CIV USN (USA) [stephen.banister@navy.mil]
Subject: FW: Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR
Attachments: Final RACR replacement pages Apr 2019.pdf; Final Ship Berth FSSR replacement pages Apr 2019.pdf; Final NRDL FSSR replacement pages Apr 2019.pdf; Draft Final-to-Final Sheet Change-Out Guide.pdf

Derek,

The plan to finalize the D-1 RACR will be through replacement pages and new pages. I'm assuming this was agreed to awhile back? Let me know if that is still the preference, and I will prepare a transmittal for the final distribution.

I'm also asking Jerry/Gilbane to fix the font issue in the electronic files.

Thanks!

V/r,
Paul

-----Original Message-----
From: Cooper, Jerry <JCooper@GilbaneCo.com>
Sent: Tuesday, April 2, 2019 1:29 PM
To: Stoick, Paul T CIV USN (USA) <paul.stoick@navy.mil>
Cc: Acharya, Arvind <AAcharya@GilbaneCo.com>; Gilmore, Clare <CGilmore@GilbaneCo.com>
Subject: [Non-DoD Source] Final Issue of HPNS D-1 RACR, Ship Berths FSSR, and NRDL FSSR

Paul,

Here's some background that you may already be aware of. The D-1 RACR includes three documents that are to be issued final simultaneously. They are: (1) D-1 RACR, (2) Ship Berths FSSR, and (3) NRDL FSSR. Two issues primarily prevented the three documents from going to final nearly 1 ½ years ago: (1) technical constraints on Gilbane being able to recommend unrestricted release for Parcel D-1 soil below 2 ft bgs, and (2) resolution of EPA's concern regarding Po-210 and the bollards. With the Navy having resolved and/or taken a position regarding these outstanding issues, the three documents can move to final.

Pursuant to the Navy's agreement with Gilbane, the draft final versions of the documents will be finalized by issuance of replacement pages and new CDs. No complete hardcopy documents will be produced, just replacement pages.

Attached are the sets of draft final-to-final replacement pages for the D-1 RACR, Ship Berths FSSR, and NRDL FSSR. Also attached is a Sheet Change-Out Guide. Please review and approve. Gilbane will then prepare, issue, and distribute hard copy replacement page sets for the hardcopy document holders, and complete copies on CD for everyone else.

The whole thing has a lot of history behind it. Let me know what questions we can answer and what else, if anything, you'd like us to do.

Thanks.

Jerry

Jerry Cooper, CHP, PMP | Principal Health Physicist/Corporate RSO | Gilbane
1655 Grant Street, Suite 1200 | Concord, CA 94520 | www.gilbaneco.com
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(360) 751-4172

DRAFT FINAL to FINAL SHEET CHANGE-OUT PACKAGE

FINAL
REMOVAL ACTION COMPLETION REPORT
RADIOLOGICAL REMEDIATION AND SUPPORT
PARCEL D-1 PHASE II

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

APRIL 2019

DOCUMENT CONTROL NUMBER: ITSI-0808-0004-0073

The attached pages and the enclosed CD are updated/new. Please replace old pages/items in the draft final version with the replacement final version pages listed below:

Page/Section	**Remove**	**Insert**
CD	Draft Final CD	Final CD
Binder Cover	Draft Final Binder Cover	Final Binder Cover
Cover Page (with Statement A)	Draft Final Cover Page	Final Cover Page
Title Page (with signatures)	Draft Final Title Page	Final Title Page
Table of Contents	Pages i to iv	Pages i to iv
Abbreviations and Acronyms	Pages v and vi	Pages v and vi
Executive Summary	Pages vii and viii	Pages vii and viii
Report Body - Section 1.2 text	Pages 5 and 6	Pages 5 and 6
Report Body – Section 3.2 text	Pages 15 and 16	Pages 15 and 16
Report Body – Section 4.7 text	Pages 31 and 32	Pages 31 and 32
Report Body – Section 8.3 text	Pages 53 to 70	Pages 53 to 72
Appendix R - Response to Comments	Contents (except cover sheet)	Replacement Contents

DRAFT FINAL to FINAL SHEET CHANGE-OUT PACKAGE

FINAL
FINAL STATUS SURVEY: SHIP BERTHS 14, 21, 22, & 29

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

APRIL 2019

DOCUMENT CONTROL NUMBER: ITSI-0808-0004-0074

The attached pages and the enclosed CD are updated/new. Please replace old pages/items in the draft final version with the replacement final version pages listed below:

Page/Section	**Remove**	**Insert**
CD	Draft Final CD	Final CD
Binder Cover	Draft Final Binder Cover	Final Binder Cover
Cover Page (with Statement A)	Draft Final Cover Page	Final Cover Page
Title Page	Draft Final Title Page	Final Title Page
Appendix A – Technical Memorandum	Contents (except cover sheet)	Replacement Contents
Appendix N – Response to Comments	Contents (except cover sheet)	Replacement Contents

DRAFT FINAL to FINAL SHEET CHANGE-OUT PACKAGE

FINAL
FINAL STATUS SURVEY OF THE FORMER NAVAL RADIOLOGICAL DEFENSE LABORATORY SITE

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

APRIL 2019

DOCUMENT CONTROL NUMBER: ITSI-0808-0004-0075

The attached pages and the enclosed CD are updated/new. Please replace old pages/items in the draft final version with the replacement final version pages listed below:

Page/Section	**Remove**	**Insert**
CD	Draft Final CD	Final CD
Binder Cover	Draft Final Binder Cover	Final Binder Cover
Cover Page (with Statement A)	Draft Final Cover Page	Final Cover Page
Title Page	Draft Final Title Page	Final Title Page
Report Body – Section 4.3 text	Pages 9 and 10	Pages 9 and 10
Appendix J – Response to Comments	None	Additional page at end of appendix

NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REPORT
FINAL STATUS SURVEY OF THE FORMER NAVAL RADIOLOGICAL DEFENSE LABORATORY SITE
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

APRIL 2019

STATEMENT A – Approved for public release; distribution is unlimited

DCN: ITSI-0808-0004-0075

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FINAL STATUS SURVEY OF THE FORMER NAVAL RADIOLOGICAL DEFENSE LABORATORY SITE
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4.0 SURVEY DESIGN

4.1 OBJECTIVE OF SURVEYS

The MARSSIM (DoD et al., 2000); the *A Nonparametric Statistical Methodology for the Design and Analysis of the Final Status Decommissioning Survey, NUREG-1505* (NRC, 1998a); and the *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions, NUREG-1507* (NRC, 1998b) were used as guidance in designing and conducting the surveys described in this FSS report. The surveys were also performed according to the requirements outlined in the RMP (ITSI Gilbane, 2013a), the Execution Plan (ITSI Gilbane, 2013b), and the TSP (ITSI Gilbane, 2013c).

The objective of the surveys was to demonstrate that residual radioactivity levels were less than the clean-up goals. To demonstrate that the objective was met, the null hypothesis that the survey unit has residual radioactivity exceeding the clean-up goals is tested. If the null hypothesis is rejected, then the alternative hypothesis that residual radioactivity in the survey unit meets the clean-up goals is accepted.

4.2 SURVEY UNITS

The former NRDL site was divided into four Class 1 survey units, each less than 1,000 m^2. The naming nomenclature for the Class 1 survey units consists of the compass quadrant (e.g., 'NW' as northwest, 'SE' as southeast). A single Class 2 survey unit (C2) was created, which consists of a 5-m wide buffer area around the Class 1 survey units. The MARSSIM classification and surface area for each survey unit are listed in Exhibit 4.

Exhibit 4. Survey Unit Summary

Parameter	Survey Units (04-PD-NRDL-xxx)				
	NE	NW	SE	SW	C2
Class	1	1	1	1	2
Surface area (m^2)	730	730	760	760	500

4.3 REFERENCE AREA

A background reference area should have similar physical, chemical, biological, geological, and radiological characteristics as the survey unit being evaluated. Background reference areas are normally selected from non-impacted areas, but are not limited to natural areas undisturbed by

human activities. Reference areas provide locations for making background measurements to compare with survey unit data.

Certain radionuclides may occur at significant levels as part of background in the media of interest (e.g., soil). Examples include members of the naturally occurring uranium, thorium, and actinium series.

An area northwest of Ship Berth 29 in Parcel D-1, shown in Exhibit 1, was used as the soil reference area. It has no history of radiological use and its surroundings, vegetation, and overall topography and proximity are similar to the former NRDL site. Also it has been used in multiple Navy projects at HPNS over a period of several years to establish a background concentration for Ra-226 (none assumed for either Sr-90 or Cs-137). No discrete radiological objects have been identified in or recovered from the reference area. The closest object found was approximately 30 m north of the reference area.

Twenty samples were collected systematically by another Navy contractor from an area between Building 526 and Berth 29 for use as a reference area population for data comparison. The reference area sample results provide a basis for net activity concentration. One hundred percent of the samples were analyzed by gamma spectroscopy and 10 percent (two samples) were also analyzed for Pu-239 and Sr-90 at a DoD ELAP accredited laboratory (TestAmerica, St. Louis) for use as reference area definitive data.

The reference area sample analytical results are summarized in Appendix B. Analytical results for Sr-90, Cs-137, and Pu-239 are included for information only as corrections for background were made only for Ra-226. Ra-226 was detected above the MDC in each of the 20 samples. The average reference area activity for Ra-226, measured by a 21-day in-growth of the 609.31 kilo-electron volt (keV) gamma energy peak for bismuth-214, was determined to be 0.375 pCi/g. This places the clean-up goal at 1.375 pCi/g of Ra-226. The average value (0.375 pCi/g) was used for background subtraction of Ra-226 for dose and risk modeling.

4.4 STATISTICAL TESTS

MARSSIM (DoD et al., 2000) recommends the use of the WRS test to conservatively evaluate field results. The WRS test is a two-sample, nonparametric procedure that can be used to

USEPA Review of the Responses to Comments on the Draft Final Status Survey of the Former Naval Radiological Defense Laboratory (NRDL) Site, Former Hunters Point Naval Shipyard, San Francisco, California, and the Draft Final Final Status Survey of the Former NRDL Site, Former Hunters Point Naval Shipyard, San Francisco, California, January 2018

Most of the previous USEPA comments were addressed and incorporated into the NRDL FSSR; the exceptions are noted in the comments below.

Evaluation of the Response to Item 4, EPA General Comment #3: The response and text revision partially addresses the comment in clarifying that Plutonium-239 (Pu-239) was only analyzed for when Strontium-90 (Sr-90) was found to exceed the release criteria. However, the revisions do not address why it was assumed that Pu-239 would only be present if Sr-90 was present above the release criteria. According to Table 5-1, Atomic Energy Commission Licenses Associated with HPS Sorted by License, of the Historical Radiological Assessment Volume II, indicates that the Naval Radiological Defense Laboratory (NRDL) was licensed to have 2000 grams of Pu-239 and 55 grams of Pu-238 under license SNM-35. The description of this material indicates it was not contained in a sealed source and it was used on-site for various applications that did not necessarily involve the use of Sr-90. Please provide revise the Draft Final Final Status Survey of the Former NRDL Site, Former Hunters Point Naval Shipyard, San Francisco, California, Former Hunter's Point Naval Shipyard, San Francisco (the NRDL FSSR) to include a detailed justification for the assumption that Pu-239 would not be present unless Sr-90 was also present, given the use of Pu-239 by the NRDL.

Navy Response: *Up to two thousand grams of Pu-239 and 55 grams of Pu-238 were licensed to the NRDL under the AEC license SNM-35. These sources were used only in building 815 and that was mostly on the 6th floor, not in the Parcel D-1 NRDL area (See the Historical Radiological Assessment (HRA) references 599, 2772, and 2910). The analytical rule (i.e., analyzing for Pu-239 only in the event Sr-90 exceeds its release criterion) for the Parcel D-1 Phase II radiological remediation was established in Worksheet #17 of the SAP, which is included as an appendix to the Execution Plan. The rule finds its basis in the conclusion of the HRA that the conduct of Operation Crossroads and the resultant decontamination of ships that participated in the tests had a significant effect upon HPNS, particularly in regards to the radiologically impacted NRDL site in Parcel D-1 and ship berths. Both Pu-239 and Sr-90 would be found in radioactive fallout as a result of the tests, and as contaminants resulting from decontamination efforts. Consequently, it is reasonable to look for elevated Pu-239 if elevated Sr-90 is found.*

Evaluation of the Response to Item #7, EPA Specific Comment #3: The response partially addresses the comment. A number of radiological commodities have been found in the vicinity of the Reference Area, and it is unclear if any radiological commodities have been found in the Reference Area. Please revise the NRDL FSSR to clarify whether any radiological commodities have been found in the Reference Area and specify the distance between the Reference Area and the closest radiological commodity that has been found in that area of Parcel D-1.

Navy Response: *No radiological commodities have been found in the Reference Area. A sentence was added to the end of 3rd paragraph of Section 4.3 stating, "No discrete radioactive objects have been identified in or recovered from the reference area. The closest object found was approximately 30 m north of the reference area."*

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NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REMOVAL ACTION COMPLETION REPORT
RADIOLOGICAL REMEDIATION AND SUPPORT
PARCEL D-1 PHASE II
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

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SAN DIEGO, CALIFORNIA

FINAL REMOVAL ACTION COMPLETION REPORT RADIOLOGICAL REMEDIATION AND SUPPORT PARCEL D-1 PHASE II HUNTERS POINT NAVAL SHIPYARD SAN FRANCISCO, CALIFORNIA

APRIL 2019

Prepared for NAVFAC Southwest by:

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1655 Grant Street, Suite 1200
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Contract Number N62473-10-D-2227
Contract Task Order 0004
Document Control Number: ITSI-0808-0004-0073

_____

Jerry Cooper, CHP, Gilbane Principal Health Physicist/Corporate RSO

_____

Clare Gilmore, Gilbane Project Manager

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LIST OF EXHIBITS

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ABBREVIATIONS AND ACRONYMS

µR/hr	microroentgens per hour
AM	Action Memorandum
ANL	Argonne National Laboratory
ARIC	area requiring institutional controls
ARS	American Radiation Services International, Inc.
bgs	below ground surface
Bi-214	bismuth-214
C&T	Curtis and Tompkins, LLC
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cm	centimeter
cm^2	square centimeter
cps	counts per second
Cs-137	cesium-137
CSO	Caretaker Site Office
CTO	contract task order
DCP	Dust Control Plan
DoD	U.S. Department of Defense
dpm/100 cm^2	disintegrations per minute per 100 square centimeters
ELAP	Environmental Laboratory Accreditation Program
ELCR	excess lifetime cancer risk
EPA	U.S. Environmental Protection Agency
FCR	field change request
FSS	final status survey
ft	foot, feet
ft^2	Square feet
GEL	GEL Laboratories, LLC
Gilbane	Gilbane Federal
GPS	global positioning system
GWS	gamma walkover survey
HPNS	Hunters Point Naval Shipyard
HRA	Historical Radiological Assessment
IAEA	International Atomic Energy Agency
IR	installation restoration
K-40	potassium-40
keV	kilo-electron volts
LLRW	low-level radioactive waste
LUC RD	land use controls remedial design
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	minimum detectable concentration

mrem/yr	millirem per year
NAVSEA	Naval Sea Systems Command
Navy	U.S. Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NELAP	National Environmental Laboratory Accreditation
NIOSH	National Institute of Occupational Safety and Health
NRC	U.S. Nuclear Regulatory Commission
NRDL	Naval Radiological Defense Laboratory
OSWER	Office of Solid Waste and Emergency Response
pCi/g	picocuries per gram
Po-210	polonium-210
Pu-239	plutonium-239
QCSR	quality control summary report
Ra-226	radium-226
RACR	Removal Action Completion Report
RASO	Radiological Affairs Support Office
RESRAD	RESidual RADioactivity
RMP	Radiological Management Plan
RO	radioactive object
ROD	Record of Decision
ROI	regions of interest
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
RPP	Radiation Protection Plan
RSY	radiological screening yard
SAP	Sampling and Analysis Plan
Shaw	Shaw Environmental & Infrastructure, Inc.
Sr-90	strontium-90
SSSD	sanitary sewer and storm drain
SUPR	Survey Unit Project Report
SUPRA	Survey Unit Project Reports Abstract
Synectics	Environmental Synectics, Inc.
TCRA	time-critical removal action
TEDE	total effective dose equivalent
TSP	task-specific plan

EXECUTIVE SUMMARY

This radiological removal action completion report documents the completion of the Phase II removal actions conducted in Parcel D-1 at the Hunters Point Naval Shipyard, San Francisco, California. It addresses the remaining site features in Parcel D-1 identified as radiologically impacted in the *Final Historical Radiological Assessment, Volume II, History of the Use of General Radioactive Materials, 1939—2003, Hunters Point Shipyard, San Francisco, California* (HRA; Naval Sea Systems Command [NAVSEA], 2004) not addressed during Phase I. Specifically, these are:

Remaining sanitary sewer and storm drain (SSSD) lines;
Former Naval Radiological Defense Laboratory (NRDL) site;
Ship Berths 14, 21, 22, and 29; and
Railroad tie stockpiles.

The removal actions were to designed to (1) substantially reduce ionizing radiation to clean-up goals, and (2) eliminate identified pathways of exposure to ionizing radiation in accordance with the *Final Basewide Radiological Removal Action Action Memorandum—Revision 2006, Hunters Point Shipyard, San Francisco, California* (AM; U.S. Department of the Navy [Navy], 2006) and the *Execution Plan: Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California* (ITSI Gilbane, 2013b). The radionuclides of concern were cesium-137, radium-226, strontium-90, and plutonium-239.

The remaining SSSD lines and railroad tie stockpiles were removed. Material found to be above the AM (Navy, 2006) clean-up goals was properly disposed of off-site. A final status survey was performed of the former NRDL site and the ship berths. Survey and sampling results confirm that surface soil and other material left in-place and/or re-used as backfill meet the Navy's clean-up goals. Remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) have been addressed.

Dose and risk modeling was performed using sample analytical results. Modeling resulted in a maximum dose of 1.4 millirem per year (mrem/yr) and a maximum excess lifetime cancer risk (ELCR) of 2.8×10^{-5}. This demonstrated that the dose and risk, under the conservative residential farmer exposure scenario, were below the project dose limit of 12 mrem/yr and an

ELCR of 3×10^{-4}. The inclusion of ingestion-related pathways in the modeling assured that dose and risk results are well within project limits. If the modeling does not take into account the ingestion-related pathways the maximum dose and risk are reduced by 50 percent. Dose and risk modeling that considers reasonably anticipated reuse in accordance with the reuse plan (i.e., reuse that does not include ingestion of produce grown in native soil) results in the maximum dose dropping from 1.4 to 0.63 mrem/yr, and the maximum ELCR from 2.8×10^{-5} to 1.4×10^{-5}. These dose and risk results are more appropriate because they reflect actual site conditions for the residential scenario, which is the most conservative planned future use.

Once the Phase II removal actions were completed, survey and sampling were performed over a large portion of Parcel D-1 to address radiation anomalies that were identified outside of areas identified as radiologically impacted. Discrete radioactive objects (ROs) were removed and subsequently disposed of off-site. There are two important points to be made:

> ROs recovered outside of areas previously identified by the HRA (NAVSEA, 2004) as radiologically impacted do not appear to be from surface-related activities involving radioactive material. Their suspected source is material dredged from San Francisco Bay used to create the present shoreline. Since radioluminescent devices containing Ra-226 were used on ships, ship decontamination, repair, and dismantling activities occurring at or near piers could have resulted in deck markers, gauges, and small metal pieces being present in the dredge material.
>
> Based on the post-removal survey and sampling results, there is a high degree of confidence that discrete ROs in soil to a depth of 2 feet (ft) below ground surface (bgs) have been identified and recovered.

Based on the above, there is the potential for ROs to be present in material below 2 ft bgs in areas where shoreline expansion has occurred since 1946 (i.e., where dredged material from the Bay was used to create the present shoreline). Based on the Navy's understanding of how shoreline expansion occurred, the potential is largely limited to areas around the 1946 shoreline (Exhibit 8-8). The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability. Land use and activity restrictions currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the Land Use Controls Remedial Design in the *Final Design Basis Report For Parcel D-1, Hunters Point Naval Shipyard, San Francisco, California* (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs.

In addition to the Phase II removal actions, radiological survey and sampling of Parcel D-1 areas outside of those identified as radiologically impacted in the HRA (NAVSEA, 2004) was performed to address discrete radiation anomalies that were identified previously by a Navy contractor near Ship Berths 22 and 29.

The Phase II removal action addressed chemical contamination only in relation to re-use as potential backfill material or waste characterization for disposal of excavated soil derived from removal of the SSSD lines in accordance with the *Execution Plan: Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California* (Execution Plan; ITSI Gilbane, 2013b). This radiological RACR does not address chemical contamination.

1.3 CURRENT AND FUTURE LAND USE

There is no current use of Parcel D-1. Following this removal action, and after other additional remedial activities are completed, Parcel D-1 will be transferred to the City and County of San Francisco for conversion to non-defense re-use. The future planned use of Parcel D-1 is mixed use residential and shoreline open space as described by the *Hunters Point Shipyard Redevelopment Plan* (San Francisco Redevelopment Agency, 2010). Public recreation access will be provided to the San Francisco Bay waterfront, and include open spaces, viewing area of the water and historic Shipyard facilities, the San Francisco Bay Trail, and restorative habitat areas.

1.4 WORK CONTROL

A series of work plan documents were prepared to guide completion of work activities performed as part of the Phase II removal action. These supporting documents are incorporated by reference and are available for review through the Environmental Restoration Program Record File (see Section 11.1).

1.4.1 Basewide Radiological Management Plan

The *Basewide Radiological Management Plan, Hunters Point Naval Shipyard, San Francisco, California* (RMP; ITSI Gilbane, 2013a) describes the survey and decontamination procedures and methodologies that were implemented by Gilbane in support of the radiological release of buildings, sites, structures, areas, materials and equipment at HPNS. The Basewide Storm Drain

and Sanitary Sewer Removal Plan, included as Attachment 1 to the RMP (ITSI Gilbane, 2013a), describes the scope and approach for removing SSSD lines and achieving radiological release of related excavated areas at HPNS.

1.4.2 Parcel D-1 Execution Plan

The Execution Plan (ITSI Gilbane, 2013b) provided guidance and procedures for performing the radiological survey of radiologically impacted structures, removal of SSSD lines, radiological screening yard (RSY) operations, and supporting off-site laboratory operations. The Execution Plan (ITSI Gilbane, 2013b) was supported by the following plans which were included as attachments to it:

Sampling and Analysis Plan (SAP; Attachment 1),

Contractor Quality Control Plan (Attachment 2),

Radiation Protection Plan (RPP; Attachment 3),

Dust Control Plan (DCP; Attachment 4)

Stormwater Pollution Prevention Plan (Attachment 5)

Accident Prevention Plan and Site Safety and Health Plan (Attachment 6)

1.4.3 Design Plan

The *Parcel D-1 Phase II Design Plan: Storm Drain and Sanitary Sewer Removal, Hunters Point Shipyard, San Francisco, California* (Design Plan; ITSI Gilbane, 2013c) included guidance for SSSD line excavation and site restoration activities within Parcel D-1, in addition to the design drawings for SSSD line removal activities.

1.4.4 Task-Specific Plans

Task-specific plans (TSPs) were developed for the FSS of the former NRDL site and the ship berths. They are:

Task-Specific Plan: Former Naval Radiological Defense Laboratory Site Final Status Survey, Hunters Point Naval Shipyard, San Francisco, California (NRDL Site TSP; ITSI Gilbane, 2013d)

Task-Specific Plan: Radiological Survey and Release of Ship Berths 14, 21, 22, and 29, Hunters Point Naval Shipyard, San Francisco, California (Ship Berths TSP; ITSI Gilbane, 2013e)

The TSPs describe the survey activities conducted in accordance with the guidelines in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NUREG-1575; U.S.

3.0 FIELD ACTIVITIES OVERVIEW

Gilbane holds radioactive material licenses from both the NRC (License No. 04-29353-01) and the State of California (License No. 9748-07), and performed CTO 0004 under those license authorities. Gilbane coordinated license responsibilities and management of radioactive material, including waste, with the Navy and other HPNS contractors providing radiological services via a memorandum of understanding. Parties included TetraTech EC, Inc.; B & B Environmental Safety, Inc.; Chicago Bridge & Iron; and Gilbane. LLRW disposal was not included as part of CTO 0004. The transportation and disposal of LLRW and non-radiological waste were conducted under separate HPNS basewide waste disposal contracts overseen by the Navy.

3.1 PERMITS AND NOTIFICATIONS

While permits are not required for TCRA operations, the Navy complies with the substantive requirements of applicable and relevant permits. Necessary authorizations were obtained from the Resident Officer in Charge of Construction (ROICC) and the HPNS Caretaker Site Office (CSO) for implementing and completing the work. Because work activities were conducted along well-traveled streets, the remedial project manager (RPM), CSO, ROICC, HPNS tenants, and HPNS security were notified of road closures and changes to traffic flow that was necessary to support the work.

Storm water management was performed in substantive compliance with the General Construction Activity Storm Water Permit program set forth by the California Regional Water Quality Control Board General Permit No. CAS000002, Water Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity.

3.2 GAMMA WALKOVER SURVEY

A gamma walkover survey (GWS) was performed prior to sampling to identify locations with the highest potential for elevated residual radioactivity based on their measured levels of gamma radiation. These locations were routinely selected for biased sampling. The GWS was performed using a Radiation Solutions, Inc., RS-700 self-contained mobile gamma ray detection system. The RS-700 system was mounted on a mobile platform (e.g., small tractor or boom lift) equipped with an adjustable throttle to allow for speed control. The detector was mounted at a

height of approximately four inches (0.1 m) above the surface, moving at a speed of 1.5 ft (0.5 m) per second, with each pass spaced 1.5 ft (0.5 m), or less based on detector field of view, from the previous pass to achieve 100 percent coverage of the area being surveyed. The spacing of each pass coupled with the detector sensitivity and field of view ensured high-density survey coverage of the area being scanned.

GWS data were position correlated using a global positioning system (GPS) receiver mated with a graphical interface system field device. The GPS antenna was mounted above the detector in such a manner to limit obstructions to aid in keeping the best satellite resolution possible. Position-correlated measurement data were logged automatically at one-second intervals. Collected data were retrieved from the RS-700 and processed using numerical and graphical methods. First, the data were plotted to ensure adequate scan coverage. A tractor speed histogram was developed using the position-correlated data as a quality control check to verify the proper speed of the detector over the ground. The data were checked for errors as well as examined for potential outliers and other anomalous features. Descriptive statistics (e.g., range, median, mean, and standard deviation) were used to assess the data set. The data were graphed on a cumulative frequency diagram to test departure from normality and to reveal characteristics of the data distribution such as dissimilar populations and data set outliers that may not be apparent otherwise. Locations with measurements greater than three standard deviations above the data set mean were routinely selected for biased sampling.

Surveys to further delineate suspected contaminated areas were performed using a Ludlum Model 44-10 gamma scintillation detector coupled to a Ludlum Model 2221 ratemeter scaler.

RS-700 and Ludlum Model 44-10 instrument data are included in Appendix B.

3.3 SAMPLING AND ANALYSIS

Sampling and analysis were performed in accordance with the SAP, included as Attachment 1 to the Execution Plan (ITSI Gilbane, 2013b). Except where available material to sample was limited, samples collected were approximately 1,000 grams in size. Visually identifiable foreign objects and debris were removed manually in the field. Samples were bagged in one-gallon resealable plastic bags, numbered, logged, and sent for laboratory analysis. Each sample was labeled and assigned a unique sample identification number. The samples were turned over to

15 cm were transferred along with the surrounding soil to the RSY for processing. No piping or other material greater than 6 inches (15 cm) was sent to the RSY, nor was non-soil material, that was encountered during excavation. Material that was identified as radioactive waste was handled as described in Section 9.1. Non-soil material was characterized, handled, and properly disposed of. Because it is considered radiologically contaminated, non-soil material was handled within a radiologically controlled area until survey and sampling data demonstrated otherwise. Care was taken to contain silt and debris that was inside the piping.

4.7 TRENCH SURVEY AND SAMPLING

Survey and sampling of the excavated trench surfaces (floor and sidewalls) were performed once soil excavation and pipe removal were complete. Where residual radioactivity above the clean-up goals was identified, the area was remediated (i.e., soil was removed) and resampled. In the event no residual radioactivity above the clean-up goals was identified (i.e., no remediation is required), then the survey data were used to demonstrate that the residual radioactivity levels inside the excavated trench meet the clean-up goals. Trench survey units did not exceed 10,760 ft^2 (1,000 m^2) in total surface area (trench floor and sidewalls).

A GWS was performed over 100 percent of the trench surfaces. The RS-700 system mounted on an engine powered telescopic boom lift was used. The boom lift served as the working platform for the technician and provided the ability to survey the trench without worker entry. The detector was mounted on an arm extending from the boom lift and controlled by the technician, allowing repositioning of the detector for improved trench floor and wall surveying. The detector was mounted either vertically or horizontally to enable survey of the trench floor and walls, respectively.

Twenty random-start systematic and up to 10 biased samples per trench survey unit were collected from the exposed trench surfaces and analyzed. Where residual radioactivity exceeding the clean-up goals was identified within the trench, the area was remediated (i.e., excavated) and post-remediation survey and sampling were performed to verify the clean-up goals are met. Samples were also collected along the pipe footprint in the trench based on contamination found on the removed SSSD lines, and to bound remediated areas.

The number and type of samples collected are shown in Exhibit 4-5. The sample results, summarized in Exhibit 4-6, demonstrate the effectiveness of the removal action. A single sample location in Zone G reported a Cs-137 concentration of 0.151 pCi/g, which exceeds Cs-137 clean-up goal of 0.113 pCi/g. A single sample location in Zone D reported a Sr-90 concentration of 0.404 pCi/g, which exceeds Sr-90 clean-up goal of 0.331 pCi/g. The soil containing the elevated radioactivity was removed and disposed as LLRW. Bounding samples were collected to verify remaining soil concentrations were below the clean-up goals.

Exhibit 4-5. Trench Sample Collection

Parameter	Number
Number of trench survey units	17
Systematic samples	340
Biased (based on GWS results) samples	110
Pipe footprint/bounding samples	88
Total samples collected	538

Exhibit 4-6. Summary of Trench Sample Results

Parameter	Radionuclide of Concern		
	Ra-226	Cs-137	Sr-90
Samples analyzed	538	538	67
Samples w/concentration > MDC	536	54	1
Number of sample exceedances	0	1[a]	1[b]
Lowest MDC (pCi/g)	0.0304	0.00917	0.0337
Highest MDC (pCi/g)	0.0508	0.0243	0.165
Minimum concentration (pCi/g)	< MDC	< MDC	< MDC
Maximum concentration (pCi/g)	1.03	0.151[a]	0.404[b]

Notes:
[a] Single sample location in Zone G reported 0.151 pCi/g, which exceeds Cs-137 clean-up goal of 0.113 pCi/g. Soil containing elevated radioactivity removed and disposed as LLRW. Highest post-remediation (i.e., remaining) Cs-137 concentration was 0.107 pCi/g.
[b] Single sample location in Zone D reported 0.404 pCi/g, which exceeds Sr-90 clean-up goal of 0.331 pCi/g. Soil containing elevated radioactivity removed and disposed as LLRW. Highest post-remediation (i.e., remaining) Sr-90 concentration was below MDC.

Dose and risk modeling of the trench surfaces was performed in RESRAD using the analytical results of samples collected from both systematically-spaced and biased locations representing the post-remediation or "as-left" trench surfaces. Modeling resulted in a maximum dose for the trenches in any zone of 1.2 mrem/yr with an ELCR of 2.0×10^{-5}.

Exhibit 8-5. Field Investigation Sample Collection

Type of Sample	Number
Bounding samples (excavation floor and walls)	20
Biased (based on highest count rate) samples	12
Stockpile samples (soil removed from excavation)	16
Total samples collected	48

Exhibit 8-6. Summary of Field Investigation Sample Results

Parameter	Radionuclide of Concern	
	Ra-226	Cs-137
Samples analyzed	48	48
Samples w/concentration > MDC	47	1
Number of sample exceedances	0	0
Lowest MDC (pCi/g)	0.070	0.038
Highest MDC (pCi/g)	0.170	0.070
Minimum concentration (pCi/g)	< MDC	< MDC
Maximum concentration (pCi/g)	0.904	0.046

8.3 ASSESSMENT OF RESULTS

As the result of the post-removal survey and sampling, four discrete ROs were identified and recovered. These are in addition to the eight ROs that were recovered earlier during the removal action implementation. The four ROs were recovered from investigation locations identified by analyzing the GWS data by ROI and contour mapping the results based on z-score. The results demonstrate how this method enables the discovery of discrete ROs with lower activities at greater depths (see Exhibit 8-7). The four ROs (RO-09 through -12) were recovered at depths between 1 to 3 ft bgs with radiation levels as low as 25 microroentgens per hour (μR/hr). The preceding eight ROs either had much higher activity or were recovered at a shallower depth.

8.3.1 Radiological Objects

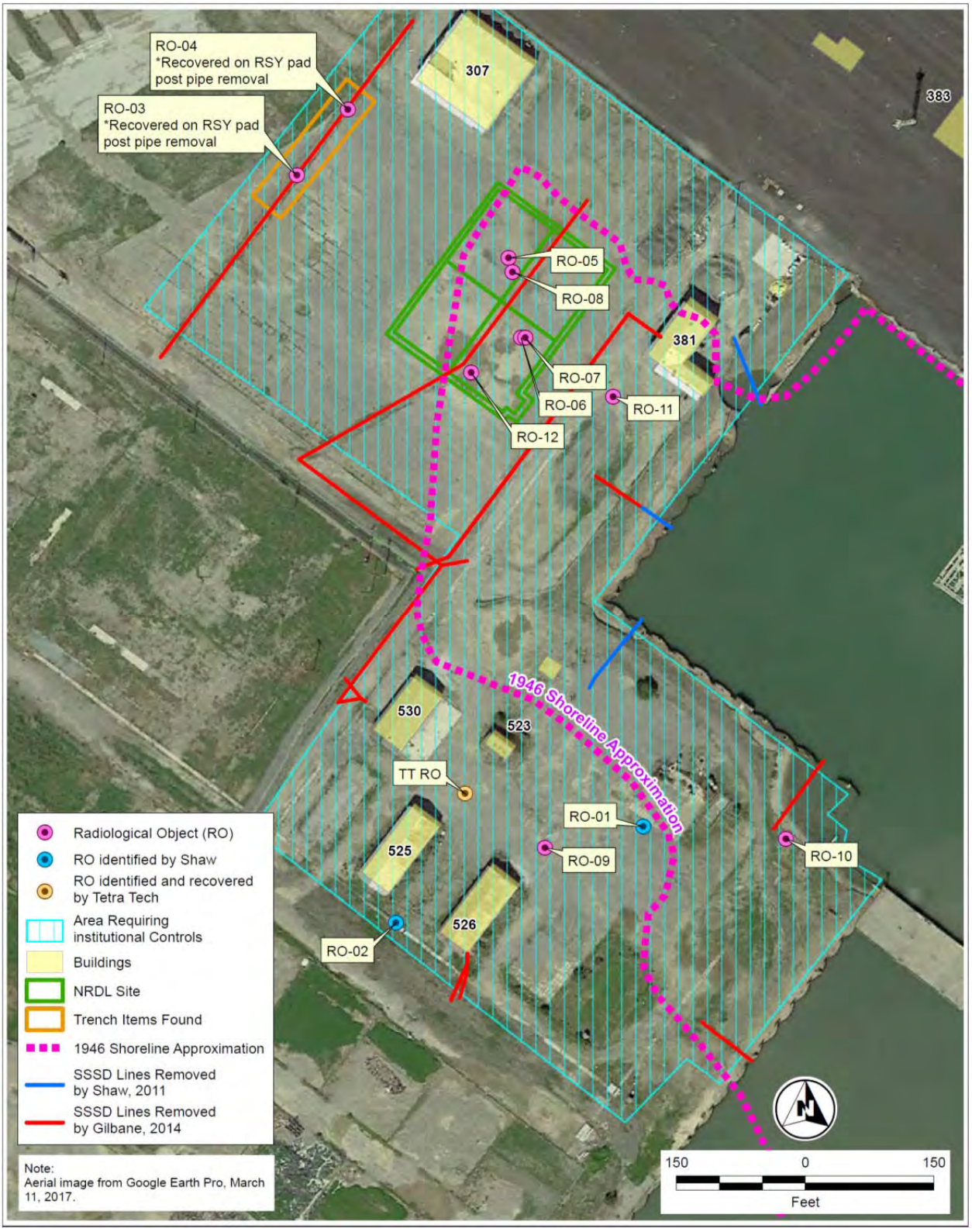
Exhibit 8-8 shows the locations where the 12 ROs were recovered. Five ROs were recovered within the footprint of the former NRDL site, which was identified as a radiologically impacted area. Two ROs were recovered during excavation of SSSD lines. The remaining five ROs were recovered outside of areas identified in the HRA (NAVSEA, 2004) as radiologically impacted.

Exhibit 8-7. Recovered Radioactive Object Data

ID	How Identified	Highest Reading[a] (µR/hr)	Recovery Depth bgs (ft)	Description
RO-01	Previously identified by Shaw	3,200	0.5	Button or deck marker
RO-02	Previously identified by Shaw	23	0.5	Small chunk of soil with visible rust particles in it
RO-03	Located by GWS on RSY Pad D-28, with Soil Pile D0034, from Trench # 04-PD-015, Zone O	4,600	N/A	Deck marker
RO-04	Located by GWS on RSY Pad D-03, with Soil Pile D0036, from Trench # 04-PD-016, Zone P	4,900	N/A	Corroded and damaged deck marker
RO-05	Located by GWS of NRDL-NW survey unit after asphalt removal	1,500	0.5	1 ½ inch piece that looked like it had a clip on one side
RO-06	Located by the GWS of NRDL-SE survey unit after asphalt removal	480	1.5	Small chunk of soil with visible rust particles in it
RO-07	Located using Ludlum Model 44-10 after the removal of RO-06	60	1.5	Small chunk of soil with visible rust particles in it
RO-08	Located using Ludlum Model 44-10 while collecting biased samples around sample 04-PD-NRDL-NW-013	500	2-3	Corroded and damaged can of some materials
RO-09	Located using ROI contour mapping of GWS results.	460	2-3	Corroded and damaged metal gauge or can
RO-10	Located using ROI contour mapping of GWS results.	420	2-3	Small chunk of soil with visible rust particles in it
RO-11	Located using ROI contour mapping of GWS results.	25	1-2	Small chunk of soil with visible rust particles in it
RO-12	Located using ROI contour mapping of GWS results.	33	1-2	Small chunk of soil with visible rust particles in it

Note:
[a]on-contact or near-surface reading

Exhibit 8-8. Locations where Discrete Radioactive Objects were Recovered



There are two important points to be made. First, the source of the five ROs recovered outside of areas previously identified by the HRA (NAVSEA, 2004) as radiologically impacted do not appear to be from surface-related activities involving radioactive material. Their suspected source is dredge material from San Francisco Bay used to fill in Parcel D-1. To illustrate this, an approximation of the 1946 shoreline was overlaid on the Exhibit 8-8 map showing the locations where discrete ROs were recovered. Material dredged from the Bay was used to create the present shoreline. Since radioluminescent devices containing Ra-226 were used on ships, ship decontamination, repair, and dismantling activities occurring at or near piers could have resulted in deck markers, gauges, and small metal pieces being present in the dredge material. Grading of dredge material is a ready explanation for the discovery of ROs outside of, but adjacent to, the 1946 shoreline.

Second, based on the post-removal survey and sampling results, there is a high degree of confidence that discrete ROs in the soil to a depth of 2 ft bgs have been identified and recovered. This is based on the sensitivity of the method described in Section 8.1. To illustrate, post-processing and analysis of the GWS data resulted in the identification and recovery of an RO within the former NRDL site after it had undergone an FSS. The GWS performed as part of the FSS did not identify the RO directly; however, post-processing and analysis of the GWS data from the former NRDL site and surrounding areas resulted in the location being investigated and the object being found.

Building on the two points above, there is the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where shoreline expansion has occurred in Parcel D-1 since 1946 (i.e., where dredge material from the Bay was used to create the present shoreline). Based on the Navy's understanding of how shoreline expansion occurred, the potential is largely limited to areas around the 1946 shoreline. The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability. The potential for ROs at depth does not present a dose or risk greater than the results of the dose and risk modeling summarized in Section 13.2. Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the Land Use Controls Remedial Design (LUC RD) in the *Final Design Basis Report For Parcel D-1, Hunters Point Naval*

Shipyard, San Francisco, California (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs.

Figures found in the HRA (NAVSEA, 2004), particularly Appendix C, illustrate what the area looked like before and after it was developed. There is some degree of uncertainty regarding the 1946 shoreline represented in Exhibit 8-8 supporting a conceptual site model where dredge material likely was used to build up the elevation of existing near-shore areas, as illustrated in Exhibit 8-9.

8.3.2 Conceptual Site Model

Grading and construction activities in the newly created and built-up land areas are the most likely explanation for the discovery of ROs outside of, but adjacent to, the 1946 shoreline approximation. Therefore, a buffer zone extending beyond the 1946 shoreline approximation is included with the 2 ft bgs restriction for Parcel D-1 Phase II (see Exhibit 8-8). .

Exhibit 8-9. Illustration of Backfilled Near-Shore Areas

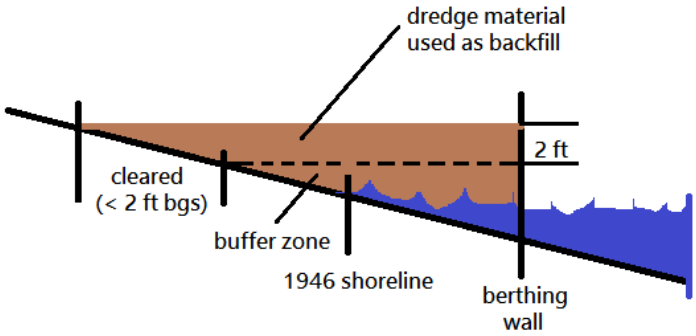


Exhibit 8-9 illustrates the purpose of a buffer zone. Though discrete ROs may have been identified and recovered to a depth of 2 ft bgs, areas backfilled with dredge material to depths greater than 2 ft bgs may extend further inland from the 1946 shoreline. The actual extent is a function of the original near-shore elevation gradient and the post-backfill final grade. That information is not available; therefore, an appropriately conservative buffer zone – encompassing discrete ROs found to date - should be established.

Three general considerations were used in placing the buffer zone shown in Exhibit 8-8. The area excluded from the area requiring restrictions does not require further action because:

1. It is furthest from the shoreline and represents the land area least likely to have been built up using dredge material;
2. It is radiologically dissimilar from the southeast portion of the RSY-2 screening pad area where the discrete ROs were found (see Exhibit 8-3); and
3. Over 2,200 linear ft of trenches were excavated ranging in depth from 2 to 8 ft. The 1,962 cy of excavated soil was radiologically screened without finding a single discrete RO.

The LUC RD (ChaduxTt, 2011), when amended, will identify the buffer zone extending beyond the 1946 shoreline approximation area as a radiological area requiring institutional controls (ARIC) below 2 ft bgs as depicted in Exhibit 8-8.

9.0 WASTE MANAGEMENT

Waste was managed in accordance with the waste management practices included in Section 3.4 of the Execution Plan (ITSI Gilbane, 2013b). Waste materials generated during this project included:

Excavated soil and materials,

Discrete ROs,

SSSD piping and related system components,

Discarded personal protective equipment (e.g., Tyvek™ coveralls, latex gloves), and

Waste generated during survey and removal activities (e.g., paper towels, filters, tape, plastic sheeting, and plastic packaging).

The production of solid waste, un-recyclable, and non-biodegradable wastes was minimized through re-use or recycling of debris found at work sites and by careful use of the appropriate quantity of materials brought onto the site. The types and quantities of chemicals brought onto the site were limited to required quantities.

Waste was classified as LLRW, hazardous waste, or non-LLRW and non-hazardous waste. Waste classification was supported by field observations and laboratory analytical results . LLRW and hazardous waste was transferred to the Navy's base-wide LLRW and hazardous waste contractors and managed under separate waste transportation and disposal contracts. Since the waste was aggregated with waste generated by other HPNS projects, no specific volumes for this project are available. Non-LLRW and non-hazardous waste was disposed by Gilbane. Waste transfer and disposal documentation is included in Appendix O.

9.1 LOW-LEVEL RADIOACTIVE WASTE

Piping debris (clay/metal), manhole concrete, and soil that exceeded the clean-up goals (see Section 2.3) were designated as LLRW. Discarded personal protective equipment and waste generated during survey and removal activities was also treated as LLRW as no attempt was made to survey and release it. The LLRW was shipped to the US Ecology Idaho facility in Grand View, Idaho, for disposal.

Twelve discrete ROs were recovered during the removal action. The ROs were characterized in preparation for disposal. A waste information sheet was prepared for each object that details the

analytical information about the source and includes a photograph of the source, radionuclide identification, estimated curie content, and radiological survey information. The information was reviewed by RASO to ensure adequate documentation for disposal as LLRW. Radioactive object data are included in Appendix P.

In 2002, Executive Order D-62-02 by the Governor, State of California (Davis, 2002) established a moratorium on the disposal of "decommissioned materials" (i.e., materials with low residual levels of radioactivity) to Class III landfills and unclassified waste management units. Class II landfills do not accept decommissioned materials.

9.2 HAZARDOUS WASTE

Excavated soil generated from IR Program sites was sampled and analyzed for the associated chemicals of concern in accordance with the SAP. Material was classified as hazardous waste based on chemical sampling analytical results.

9.3 NON-HAZARDOUS WASTE

Based on sample analytical results, railroad ties (and railroad tie material) were considered suitable for release from radiological controls and deemed non-LLRW. The material was disposed as non-hazardous waste at the Keller Canyon Landfill, a California permitted Class I landfill in Pittsburg, California, that accepts decommissioned materials for disposal.

Asbestos waste was transported to the Altamont Landfill in Livermore, California, that accepts friable asbestos wastes.

10.0 DEMONSTRATION OF COMPLETION

The Phase II removal action addressed the remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that were not addressed as part of the Phase I removal action. Specifically, these were:

Remaining SSSD lines;

Former NRDL site;

Ship Berths 14, 21, 22, and 29; and

Railroad tie stockpiles.

The removal action is deemed to be complete once the removal action objectives are met. The removal action objectives for the Phase II removal action were to: (1) implement the AM (Navy, 2006), and (2) protect the public health and welfare and the environment. Residual radioactivity was demonstrated to be less than the clean-up goals for surface and volumetric activity given in Exhibit 2-2, which satisfies the first objective. The second objective was satisfied by demonstrating that residual radioactivity will result in a TEDE to an average member of the critical (screening) group of less than 12 mrem/yr and an ELCR of less than 3×10^{-4}.

10.1 REMAINING SANITARY SEWER AND STORM DRAINS

The remaining SSSD lines in Parcel D-1, shown in Exhibit 1-2, were excavated and removed. The trenches were characterized and remediated as necessary. An FSS of the excavated trench surfaces was then performed. Soil removed during trench excavation was screened for re-use as backfill. Exhibit 10-1 is a comparison of the upper bound sample results for the trench and backfill, and the resulting dose and risk modeling, versus the clean-up goals (see Section 2.3). No further action is required and unrestricted release is recommended for removal of SSSD lines based on the following:

Remaining SSSD piping and components were excavated and removed. Excavated trenches were characterized and remediated as necessary. Impacted soil areas with elevated sampling results were sufficiently bounded and remediated.

Excavated soil was radiologically screened. Analytical results for Ra-226, Cs-137, and Sr-90 from systematic and biased samples collected demonstrate the clean-up goals for volumetric activity have been met for excavated soil re-used as backfill material.

An FSS of the excavated trench surfaces was performed. Analytical results for Ra-226, Cs-137, and Sr-90 from systematic and biased samples collected from the excavated

trench surfaces demonstrate the clean-up goals for volumetric activity have been met for the trench surfaces.

Dose and risk modeling of the trench surfaces and the backfill material was performed. Using a conservative exposure scenario, the modeling results demonstrate the clean-up goals for dose and risk have been met.

Exhibit 10-1. SSSD Line Removal Results vs. Clean-Up Goals

Type of Clean-Up Goal	Measurement Parameter	Clean-Up Goal[a]	Upper Bound	
			Trench	Backfill
Volumetric Activity (pCi/g)	Ra-226	1.0	0.655	0.807
	Cs-137	0.113	0.107	0.0968
	Sr-90	0.331	< 0.165	0.151
Dose (mrem/yr)	N/A	12	1.2	0.81
Risk (ELCR)	N/A	3×10^{-4}	2.0×10^{-5}	1.2×10^{-5}

Note:
[a] Source: Section 2.3

Trenches were backfilled with soil materials from one of the following two sources:

Soil screened and cleared on RSY pads and subsequently meeting the clean-up goals. The soil was accepted upon receipt of written RASO approval. The majority of backfill consisted of this soil.

Approved on-base import fill from the "Jericho" soil stockpile dedicated for use as SSSD line trench backfill.

Based on the samples collected and analyzed from the trench and excavated soil, the soil concentrations of the radionuclides of concern are less than the clean-up goals. The calculated dose and risk are less than 12 mrem/y with ELCR less than 3×10^{-4}, which support unrestricted release.

10.2 FORMER NRDL SITE

An FSS of the former NRDL site was performed to determine whether residual radioactivity is present in the surface soil at the former NRDL site. Exhibit 10-2 is a comparison of the upper bound results for the former NRDL site versus the clean-up goals. The surface soil meets the clean-up goals based on the following:

GWS was performed over 100 percent of the former NRDL site. Potential scanning anomalies were investigated and found to represent variability in background. No ROs were found during the FSS.

Impacted soil areas with elevated sampling results were sufficiently bounded and remediated (or no impacted soil areas with elevated sampling results were found).

Analytical results for Ra-226, Cs-137, and Sr-90 from systematic samples collected from the former NRDL site demonstrate the clean-up goals for volumetric activity have been met.

Dose and risk modeling performed using a conservative exposure scenario demonstrates the clean-up goals for dose and risk have been met.

Exhibit 10-2. Former NRDL Site Results vs. Clean-Up Goals

Type of Clean-Up Goal	Measurement Parameter	Clean-Up Goal[a]	Maximum Value
Volumetric Activity (pCi/g)	Ra-226	1.38	0.996
	Cs-137	0.113	0.113
	Sr-90	0.331	0.226
	Pu-239	2.59	N/A[b]
Dose (mrem/yr)	N/A	12	1.2
Risk (ELCR)	N/A	3×10^{-4}	2.5×10^{-5}

Notes:
[a] Source: Section 2.3
[b] No analyses performed; see analyses rules in Section 3.3.1

The surface soil at the former NRDL site was surveyed and sampled in accordance with MARSSIM (DOD et al., 2000) and dose and risk modeling was performed using the survey and sampling results.

10.3 SHIP BERTHS 14, 21, 22, AND 29

An FSS of Ship Berths 14, 21, 22, and 29 was performed to determine whether residual radioactivity was present in the surface soil and structure surfaces (e.g., asphalt, concrete) at the ship berths. Exhibit 10-3 is a comparison of the upper bound results for Ship Berths 14, 21, 22, and 29 versus the clean-up goals. The surface soil and structure surfaces meet the clean-up goals based on the following:

GWS was performed on 100 percent of the ship berth soil areas. Potential scanning anomalies were investigated and found to represent variability in background. No ROs were found.

Impacted soil areas with elevated sampling results were sufficiently bounded and remediated (or no impacted soil areas with elevated sampling results were found).

Analytical results for Ra-226, Cs-137, and Sr-90 from systematic samples collected from the ship berth soil areas demonstrate the clean-up goals for volumetric activity have been met.

Radiological surveys performed on remaining ship berth structures demonstrate the clean-up goals for surface activity have been met.

Dose and risk modeling performed using a conservative exposure scenario demonstrates the clean-up goals for dose and risk have been met.

Exhibit 10-3. Ship Berth Results vs. Clean-Up Goals

Type of Clean-Up Goal	Measurement Parameter	Clean-Up Goal[a]	Maximum Value
Volumetric Activity (pCi/g)	Ra-226	1.0	0.843
	Cs-137	0.113	<0.074[b,c]
	Sr-90	0.331	0.326
	Pu-239	2.59	<0.036[c]
Surface Activity (dpm/100 cm^2)	Total Alpha	100	88
	Total Beta	1,000	839
	Removable Alpha	20	14
	Removable Beta	200	29
Dose (mrem/yr)	N/A	12	1.4
Risk (ELCR)	N/A	3×10^{-4}	2.8×10^{-5}

Note:
[a] Source: Section 2.3
[b] Ship Berth 22 location with elevated Cs-137 sample result (0.143 pCi/g) remediated; post-remediation results less than MDC
[c] MDC reported in lieu of sample result which is less than MDC

The surface soil and structure surfaces at Ship Berths 14, 21, 22, and 29 were surveyed and sampled in accordance with MARSSIM (DoD et al., 2000) and dose and risk modeling performed using the survey and sampling results.

10.4 RAILROAD TIE STOCKPILES

The railroad ties were radiologically surveyed, released from radiological controls, and disposed as non-LLRW. None of the railroad tie material was found to have residual radioactivity exceeding the clean-up goals (see Section 2.3).

11.0 COMMUNITY RELATIONS

The public outreach process was conducted in accordance with the *Community Involvement Plan Update, Hunters Point Naval Shipyard, San Francisco, California* (Navy, 2014) prepared for HPNS to facilitate community involvement in the decision-making process.

11.1 PUBLIC INFORMATION

The AM (Navy, 2006), the work plans and reports discussed in Section 1.5, and other documentation associated with remediation activities at HPNS are contained in the Environmental Restoration Program Record File for the site. The Environmental Restoration Program Record File is maintained by Naval Facilities Engineering Command Southwest. The Navy, as lead agency with state agency concurrence, has overall responsibility for public participation activities. As such, the above information concerning Parcel D-1 is also available to the public at two local information repositories: the City of San Francisco Main Library and the Hunters Point Naval Shipyard Library (located near the entrance to the base). The information repositories are where the public can review any of the documents associated with the Environmental Restoration Program Record File. Public Participation

To encourage local participation in the hazardous waste clean-up program at HPNS, the Navy hosts community meetings. The meetings include presentations of on-going clean-up work at HPNS to inform the public.

The Navy hosted community meetings on April 9, September 2, and December 2, 2015, and April 13, 2016 to apprise community members of the remediation work being performed at HPNS. At each of the meetings, all meeting attendees were invited to ask questions of the Navy and its contractor and were encouraged to join breakout sessions to discuss and ask representatives from the regulatory agencies questions about the remediation activities at HPNS. The Navy also updated the regulatory agencies on the progress of the project, and that information was relayed to the community through a variety of agency outreach initiatives.

12.0 REMOVAL ACTION COSTS

A summary of the estimated costs incurred to perform the Phase II radiological remediation and support activities at Parcel D-1 as reported in this RACR are shown in Exhibit 12-1. The cost of this removal action is approximate due to other Navy contractors performing portions of the removal action activities, such as off-site transportation and disposal.

Exhibit 12-1. Parcel D-1 Phase II Removal Action Costs

Activity	Cost
Project Management and Plans	$315,000
Field Work (mobilization/demobilization, removal actions, site restoration)	$6,800,000
Reporting and Technical Memorandums	$458,000
Total Costs[a]:	$7,537,000

Note:
[a]does not include LLRW and non-LLRW processed by the Basewide Radiological Contractor and the non-LLRW Navy transportation and disposal contractor to avoid double-counting of waste costs reported in other RACRs and /or reports.

13.0 CONCLUSIONS

The close-out of the Phase II removal actions, in conjunction with the close-out of the Phase I removal actions (Shaw, 2014), completes the radiological remediation of site features identified by the HRA (NAVSEA, 2004) in Parcel D-1 as radiologically impacted. This included the radiological surveying, sampling, and remediation performed in Parcel D-1 related to:

SSSD line removal;

Former NRDL site FSS;

Ship Berths 14, 21, 22, and 29 FSS; and

Railroad tie stockpile survey and disposal.

There are no remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that have not been addressed.

13.1 CLEAN-UP GOALS

Survey and sample results were quantitatively compared to the clean-up goals for HPNS established in the AM (Navy, 2006) for the radionuclides of concern identified in the HRA (NAVSEA, 2004). Material found to be above the clean-up goals has been properly disposed of off-site. An FSS has been performed and/or survey and sample results provided to justify that surface soil and other material left in-place and/or re-used as backfill meet the clean-up goals. Consistent with the ROD (Navy, 2009), further remedial actions (implementation of land use and activity restrictions) will occur to address risk associated with the potential for ROs in material below 2 ft bgs.

13.2 DOSE AND RISK MODELING

Dose and risk modeling was performed in RESRAD using sample analytical results. Modeling resulted in a maximum dose of 1.4 mrem/yr and a maximum ELCR of 2.8×10^{-5}. This demonstrated that the residual dose and risk, under the conservative residential farmer exposure scenario, were below the project dose limit of 12 mrem/yr and an ELCR of 3×10^{-4}. The planned future use of Parcel D-1 ranges from recreational to residential use. Since existing land use and activity restrictions at HPNS prohibit the consumption of food grown on-site, the ingestion-related pathways included in the modeling are another layer of conservatism that assures dose and risk results are well within project limits based on planned future re-use.

Turning off the ingestion-related pathways in the model – making the model consistent with the food consumption restrictions - reduces the maximum dose and risk by 50 percent. The maximum dose drops from 1.4 to 0.63 mrem/yr. The maximum ELCR drops from 2.8×10^{-5} to 1.4×10^{-5}. These dose and risk results are more appropriate because they reflect actual site conditions for the residential scenario, which is the most conservative planned future use. The RESRAD dose and risk results for the survey unit presenting the maximum dose and risk (Ship Berth Survey Unit 04-PD-SB-14S) are provided in Appendix Q.

Discrete ROs may exist in material below 2 ft bgs (see Section 13.3). However, their discrete form and buried condition severely restricts their ability to contribute significantly to external, inhalation, or ingestion exposure pathways.

13.3 DISCRETE RADIOACTIVE OBJECTS

Once the Phase II removal actions were completed, survey and sampling were performed over a large portion of Parcel D-1 based on radiation anomalies that were identified outside of areas identified as radiologically impacted. Discrete ROs were subsequently recovered. There are two important points to be made:

> ROs recovered outside of areas previously identified by the HRA (NAVSEA, 2004) as radiologically impacted do not appear to be from surface-related activities involving radioactive material. Their suspected source is material dredged from San Francisco Bay used to create the present shoreline. Since radioluminescent devices containing Ra-226 were used on ships, ship decontamination, repair, and dismantling activities occurring at or near piers could have resulted in deck markers, gauges, and small metal pieces being present in the dredge material.
>
> Based on the post-removal survey and sampling results, there is a high degree of confidence that discrete ROs in soil to a depth of 2 ft bgs have been identified and recovered.

Based on the above, there is the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where shoreline expansion has occurred in Parcel D-1 since 1946 (i.e., where dredge material from the Bay was used to create the present shoreline). Based on the Navy's understanding of how shoreline expansion occurred, the potential is largely limited to areas around the 1946 shoreline. The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability.

Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the LUC RD (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs.

14.0 CERTIFICATION STATEMENT

I certify that this RACR memorializes the completion of the Phase II removal actions conducted in Parcel D-1 at the former HPNS. The Phase II removal actions achieved the radiological removal action objectives identified in the AM (Navy, 2006) for the remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that were not addressed in the Phase I removal actions. The single provision is that notifications of the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where dredge material from the Bay was used to create the present shoreline is required in the Finding of Suitability to Transfer. This is necessary in order to inform procedures that may be needed if intrusive site activities below 2 ft bgs are performed in the future at Parcel D-1.

There are no remaining site features in Parcel D-1 identified as radiologically impacted in the HRA (NAVSEA, 2004) that have not been addressed. No additional construction activities for remediated areas are anticipated at this time, thus the removal action is deemed complete.

BRAC Environmental Coordinator
Hunters Point Naval Shipyard

MAY 31, 2018
Date

15.0 REFERENCES

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Reviewer:	Department of Toxic Substances Control (DTSC) Comments from Ms. Juanita Bacey, Project Manager Brownfields and Environmental Restoration Program	**Date of Comments**	Email correspondence dated 13 Nov 2017

Item	Review Comment	Navy Response
1	(*DTSC General Comment #1*) The RACR indicates that sampling and surveys were limited to a depth of 2 ft bgs and that there is a potential for radiological objects to be present in material below 2 ft bgs. Therefore, an unrestricted free release is not possible for this parcel and a Covenant to Restrict the Use of Property (CRUP) will be required. The Conclusion section of the first two documents (are) above recommend unrestricted release. Please revise.	The Final Status Survey (FSS) reports for the former NRDL site and the ship berths have been modified to no longer recommend release to unrestricted use. The two FSS reports are revised to remove the unrestricted release recommendation. They now state that the surface soil and structures meet the Navy's cleanup goals as a result of the MARSSIM based investigation; however, the potential for radiological objects (RO) below 2 feet bgs remains. A LUC/RD addendum will be prepared to address the potential for ROs in subsurface below 2 feet bgs only within the 1946 shoreline expansion area and a buffer that encompasses all recovered ROs at Parcel D-1.

Reviewer:	**California Department of Public Health (CDPH) Comments** from Mr. Roger Lupo, via email to Ms. Juanita Bacey, Project Manager, Brownfields & Environmental Restoration, Department of Toxic Substances Control (DTSC) *(This review was performed in support of the Interagency Agreement between DTSC and CDPH.)*	**Date of Comments**	Email correspondence dated 14 Nov 2017

Item	Review Comment	Navy Response
2	(*CDPH General Comment #1 from R. Lupo*) In the executive summary on page viii, the text talks of the potential for radioactive objects (RO) below two foot of the ground surface, this will	Comment is noted. Discussion regarding suitability for unrestricted release has been removed. A LUC/RD addendum will be prepared

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	require a land use covenant detailing the need for protective measures in the advent of future soil excavation. Measures to include notification of public of the potential for finding RO's during excavation, notification of the workers of the potential for finding RO's, the need to have Health Physics support during excavation for the protection of the workers and of the public. Measures to include engineered barriers and administrative protective actions to protect the health and safety of the site workers and the public. I am probably getting ahead of the process in mentioning a LUC at this time, but thought I would get the idea started.	spelling out any particular additional or different specific requirements/conditions/ notifications for implementing the institutional controls (ICs) appropriately to address the potential for ROs below 2 feet bgs within the 1946 shoreline expansion area.

Reviewer:	**California Department of Public Health (CDPH) Comments** from Dr. Sheetal Singh, PhD, Sr Health Physicist, Environmental Management Branch (EMS) via letter addressed to Ms. Juanita Bacey of DTSC *(This review was performed in support of the Interagency Agreement between DTSC and CDPH.)*	**Date of Comments**	15 Nov 2017

Item	Review Comment	Navy Response
3	*(CDPH General Comment #1)* The cover page of this work plan does not have appropriate signatures by technical lead and project manager for this project. Please include appropriate signatures in the revised version of the document.	Signatures will be added to the final report.
4	*(CDPH General Comment #2)* It is EMB's understanding that the Navy is requesting radiological unrestricted release recommendation (RURR) from CDPH for the first two feet of soil below the ground surface and the soil below the two feet require institutional controls for the following: • Remaining sanitary sewer and storm drain line (SSSD) (Work Packages 108, 109, 110 and 111)	The comment is noted. The FSS reports for the former NRDL site and ship berths have been modified to no longer recommend release to unrestricted use for the surface soil and structures due to the potential that remains for ROs below 2 feet bgs. Unrestricted release

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	• Former Naval Radiological Defense Laboratory (NRDL Site), • Ship Berths 14, 21, 22 and 29 • Railroad tie stockpiles Please note that CDPH-EMB cannot approve RURR for the first two feet of all areas of Parcel D-1 Phase II as in these designated areas discrete radiological objects exist below 2 feet. If the Navy plans to implement land use controls and activity restrictions below the two feet of soil, the Radiological Health Branch has to approve this Removal Action Completion Report.	request and no further action recommendation for removed SSSD lines are warranted except for those SSSD trenches located within the 1946 shoreline expansion area and a buffer around the 1946 shoreline expansion area and a buffer that encompasses all recovered ROs at Parcel D-1 although a couple of ROs,. Two ROs recovered outside of the 1946 shoreline expansion area within the trench excavation zones and four ROs recovered just outside of the expansion area located within the Southwest Block are incidental and the likelihood of ROs outside that area is considered incidental and of low probability. The railroad tie stockpiles no longer are present in Parcel D-1. They were radiologically surveyed, released from radiological controls, and disposed as non-low level radioactive waste.

Reviewer:	**US Environmental Protection Agency (EPA) Comments** from Ms. Lily Lee, Remedial Project Manager	**Date of Comments**	17 November 2017

Item	Review Comment	Navy Response
5	(*EPA General Comment #1*) This review does not include comments on Section 5.0, Former NRDL Site Final Status Survey, and Section 6.0, Ship Berths 14, 21, 22, and 29 Final Status Survey, which will be provided on the related Final Status Survey Reports, which are also under review separately. Changes made in response to those comments should be made to Sections 5.0 and 6.0 of the Draft Radiological Removal Action Completion Report Radiological Remediation	The comment is noted. There are no changes to the FSS reports for the former NRDL site or Ship Berths 14, 21, 22, and 29 that require modifications to Sections 5.0 and 6.0.

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	and Support, Parcel D-1 Phase II (the Draft RACR), as applicable.	
6	(*EPA General Comment #2*) Section 1.4.5 (Work Variances) of the Draft RACR includes four Field Change Requests (FCRs) that require further explanation to fully understand the scope of the activity and approval process for these changes, as follows:	Please refer to the responses to EPA General Comment 2a through 2d below.
6a	(*EPA General Comment #2a*) FCR Number 001 states that the Sampling and Analysis Plan (SAP) specified a five-day in-growth period for preliminary screening analysis but that a decision was made in the field that no in-growth was needed. Also, it is unclear whether this screening analysis was for measurements in a field laboratory or a more permanent on-site laboratory. In addition, the text does not state to which analysis or radionuclide this FCR applies. Presumably, this FCR is in reference to the radium 226 (Ra-226) analysis, but this should be confirmed. Please explain why an approved SAP requirement was changed in the field and how it was determined that providing an analysis with no in-growth time would provide usable screening data and specify the radionuclide(s) to which this FCR applies. Please revise the text to include these details and to include information about which oversight and/or Quality Assurance (QA) management approvals were obtained for this change. Finally, please also include information about where the change request and approvals are documented.	The wording in Exhibit 1-3 for FCR No. 001 was modified to clarify that the FCR was prepared in the nature of a correction. The SAP specified a 5-day in-growth period for screening samples by gamma spectroscopy but, as noted in the FCR, the gamma screening method requires no in-growth period and the definitive data method requires a 21-day (minimum) in-growth period, which is part of the laboratory analytical protocol. The in-growth period is necessary to accommodate Ra-226 secular equilibrium and is applied to samples analyzed by gamma spectroscopy where the Ra-226 concentration is to be inferred based on the concentration of its progeny Bi-214. The FCR was prepared by the project chemist, reviewed by the technical director, and approved by the project manager.
6b	(*EPA General Comment #2b*) FCR Number 003 states that the SAP specified sampling every three meters	The wording in Exhibit 1-3 for FCR No. 003 was

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	and conditional Strontium-90 (Sr-90) analysis if pipe segment samples exceeded the Cesium-137 (Cs-137) release criterion. Exhibit 1-3 states that per an agreement with the Navy's Radiological Affairs Support Office (RASO), only ten percent of pipe sediment samples exceeding the Cs-137 release criteria would undergo Sr-90 analysis and confirmation samples for pipe segments would be collected every twenty meters. However, the text does not state why it was considered acceptable to only analyze ten percent of samples exceeding the Cs-137 release criteria for Sr-90 or why the sampling frequency was decreased from the original requirements in the SAP. Please revise the Draft RACR to address these concerns and to also include information about the specific oversight management and/or QA management approvals that were obtained for these changes and how/where the approvals are documented.	modified to better explain the solution. The number of samples collected of pipe sediment by rule was found to be excessive and impacting the project schedule. The reduction in number was determined by the Navy to continue to meet the purpose for which the sampling was being performed, i.e., characterizing the sediment itself for waste disposal as well as informing excavation activities regarding possible contamination due to leakage. The number of confirmation samples collected from the trenches post-excavation and the types of analyses performed based on the rules were not changed. The rule for analyzing for total Sr based on a Cs-137 exceedance was limited in its application to confirmation samples and was not applied to samples collected for characterizing pipe sediment for waste disposal as well as for informing excavation activities regarding possible contamination due to leakage. The FCR was prepared by the project chemist, reviewed by the technical director, and approved by the project manager.
6c	(*EPA General Comment #2c*) FCR Number 007 states that the analytical method specified for manganese in the SAP was changed to the same method as that specified for lead. While this may be acceptable, the RACR should specify the actual analytical methods and whether the analytical method change for manganese still met	An incorrect version of FCR No. 007 was inadvertently attached to the Draft RACR and has been replaced with the correct approved version. In addition, the wording in Exhibit 1-3 for FCR No.

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	the required detection limit requirement. Please revise the Draft RACR to include this information and to state who was responsible for the approval of this change and how/where the approvals are documented.	007 was modified to clarify change was in accordance with the SAP.
6d	(*EPA General Comment #2d*) FCR Number 008 states that the RS-700 system work instruction specified a three hundred second count time for quality control checks but a field change was made to only require a one hundred eighty second count time. Please revise the text to explain how it was determined that the one hundred eighty second count time was sufficient for the purpose of counting quality control check standards and which management or QA staff approved this change and how/where the approvals are documented.	The wording in Exhibit 1-3 for FCR No. 008 was modified to better explain the FCR was prepared in the nature of a correction of a typographical error. The documents that the work instruction was patterned after call for a 180-sec QC check.
7	(*EPA General Comment #3*) Section 3.3 (Sampling and Analysis) states the laboratories are accredited under the Department of Defense (DoD) and State of California accreditation programs; however the text does not specify if all three of the listed laboratories have both accreditations, and if the accreditations are applicable to radiological analyses. Please revise this text to include this information.	A sentence was added to Section 3.3, 2nd paragraph: "*The certifications for the matrices and methods held by each laboratory are listed in the SAP (Worksheet #23)*."
8	(*EPA General Comment #4*) The third paragraph of Section 3.3.1 (Radiological Analyses) states that if sample results were greater than or equal to the Cs-137 or Sr-90 release criteria, they were analyzed by alpha spectroscopy for Plutonium-239 (Pu-239). While it is understood that Cs-137 and Sr-90 are fission products associated with the fission of Pu-239, the Historical Radiological Assessment (HRA) indicates that Pu-239 was also obtained in pure form as sources that were used in the Naval Radiological Defense Laboratory (NRDL), yet the text	The HRA (Section 6.1.2) reports that, "*Radioactive sources, including radiography devices, were found to leak radioactivity occasionally*." The leaking source was returned to the manufacturer or disposed by regulated means. The HRA continues, "*There is historic evidence of sources being repaired, resurveyed, and placed back into*

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	does not indicate whether any samples were analyzed by alpha spectroscopy for Pu-239 without finding exceedances of Cs-137 or Sr-90. Please revise the Draft RACR to address this concern.	*service….It is reasonable to assume that any needed clean-up was performed if the leaking source caused radioactive contamination to spread beyond the source container because this was a common practice and necessary to eliminate future problems*." A sentence was added to Section 3.3.1, last paragraph, stating, "*No samples were analyzed for Pu-239 where there was not an exceedance for either Cs-137 or Sr-90*."
9	(*EPA General Comment #5*) The summary of results should include the associated counting or total propagated uncertainty. Exhibit 4-4, Summary of Radiological Screening Yards (RSY) Sample Results; Exhibit 4-6 Summary of Trench Sample Results; Exhibit 5-2, Summary of NRDL Sampling Results; and Exhibit 6-1, Summary of Ship Berth Sample Results list the maximum concentration of radionuclides of concern (ROCs) detected, as well as any noted release criteria exceedances. However, the results are not reported with the associated counting or total propagated uncertainty, and the text does not state whether any of the maximum results or those that showed an exceedance had any associated qualifiers from the data validation. For completeness and clarity, please revise the tables to include the uncertainty and the text to discuss whether any of the maximum results or those that showed an exceedance had any associated qualifiers from the data validation.	The uncertainties and data qualifiers associated with the sample results are included in the laboratory analytical results contained in the referenced reports supporting the RACR. For brevity they are not included in the summary table exhibits in the RACR body. Section 3.3.3 summarizes data quality issues that were identified with the data themselves.
10	(*EPA General Comment #6*) Section 4.7 (Trench Survey and Sampling) states on page 29 that dose and risk	Section 2.5, Dose and Risk Modeling, specifically

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	modeling of the trench surfaces was performed in RESRAD using analytical results, but does not state which sample results were used in the modeling. For example, it is unclear if all data points were entered into RESRAD, if only the maximum results were used, if results that showed exceedances of a release criterion were used, or if only post-remediation sample results were included in the RESRAD model. Please revise the RACR to clarify the results that were input into RESRAD.	the last bullet of the first paragraph, was clarified to state, "*The average radionuclide concentration was used, with the net average concentration above background used for radionuclides present in background (e.g., Ra-226)*."
11	(*EPA General Comment #7*) Section 4.9 (Backfill, Compaction, and Testing of Excavated Trenches, Page 31) of the Draft RACR states that imported backfill material from the "Jericho" soil stockpile underwent appropriate screening and Navy approval in Section; however, Attachment 1 (Jericho Soil Stockpile Radiological Screening Data) does not present results for Sr-90 or Pu-239, which are radionuclides of concern at Parcel D-1. It is uncertain if soil was tested for these radionuclides prior to using the Jericho soil stockpile as backfill material. Parcel D-1 should not be approved for unrestricted use until the fill material is tested for all radionuclides of concern. Please explain why the Jericho soil backfill material was not tested for all radionuclides of concern, notably Sr-90 and Pu-239. Alternatively, please sample the Jericho soil backfill to analyze for Sr-90 and Pu-39 and present results prior to finalization of the RACR to ensure removal action goals were met.	The Jericho soil stockpile, also known as Decker Island aggregate material, consisted of clean (i.e., radiologically non-impacted) offsite fill material brought onsite. The purpose of the sampling was to verify that the material did not contain NORM in concentrations above the release criteria. Attachment 1 was replaced with the complete borrow source assessment, which includes geotechnical, chemical, and radiological test data results.
12	(*EPA General Comment #8*) The draft describes unexpected radiological objects found in sediment used as fill. Though beyond the scope of these comments, this finding raises the question of potential similar situations elsewhere on the Shipyard where sediment could also have been used as fill and where Tetra Tech EC's	The comment is noted.

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	practices may have always followed Workplan requirements. We can revisit this question separately later.	
13	(*EPA Specific Comment #1)* - **Section 4.4, Trench Excavation, Page 24**: The third paragraph states that abandoned steam piping wrapped in asbestos-containing material was found and an asbestos contractor was brought in to monitor the air; however, the results of this air monitoring are not presented in this section or referenced. If the results are available, please reference the appropriate section or appendix in the Draft RACR.	Section 4.4, last paragraph, was modified to clarify that air monitoring for asbestos was not initiated, but continued. The air sample results for asbestos are found in Appendix E.
14	(*EPA Specific Comment #2*) - **Section 4.5, Radiological Screening Yard Operations, Page 27**: Section 4.5 states that samples of soil excavated from installation restoration (IR) sites were analyzed for re-use as backfill or waste characterization but does not discuss what constituents were detected above chemical clean-up goals or how much soil was disposed. As Appendix K, IR Site Chemistry Sampling Results only contains laboratory data, a summary of chemical exceedances that resulted in the off-site disposal of soil should be provided. Please revise the Draft RACR to include a discussion of constituents found above clean-up goals in excavated soil and an associated summary table.	Exhibit 4-2 was modified to include the volume of screened soil disposed as hazardous waste (63 m^3). Section 4.5, next to last paragraph, was modified to discuss the specifics of the sample exceedance: "*Only one sample exceeded the IR Program site chemical clean-up goal. The sample exceedance was for benzo(a)pyrene in IR 70, which is associated with Zone P. The exceedance resulted in the excavated soil, approximately 63 m^3, being disposed as hazardous waste*."
15	(*EPA Specific Comment #3*) – **Section 4.6, Removal of Piping and System Components, Pgs 27 through 28:** Section 4.6 indicates that non-soil material was characterized, handled, and properly disposed of; however, the volume of non-soil disposed of and the landfill to which it was sent to is not discussed. Additionally, while Section 9.0, Waste Management (Pages 54 through 55), briefly discusses waste	A sentence was added to Section 4.6, 1st paragraph, stating: "*Approximately 1,642 linear m of piping were removed*." As noted in Section 4.8, 2nd paragraph, piping and non-soil material that exceeded the clean-up goals were turned over to

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	management practices, the volume of non-soil disposed off-site is unclear. Please revise the Draft RACR to include additional detail regarding the volume and disposal of non-soil material removed.	the Navy's LLRW waste contractor. A sentence was also added to Section 9.0 explaining, "*Since the waste was aggregated with that generated by other HPNS projects, no specific volumes for this project are available*." Lastly, a sentence was added to Section 9.1 stating, "*The LLRW was shipped for disposal to the US Ecology Idaho facility in Grand View, Idaho*.".
16	(*EPA Minor Comment #1*) – **Appendix H, Daily Activity Reports, PDF Page 2370 and PDF Page 2467:** Several pages within Appendix H are out of order, including the Daily Activity Report dated 9/18/17 on PDF Page 2370 and Field Activity Report for 11-26-13 on PDF Page 2467. Please ensure all daily reports are in chronological order.	The order of pages in Appendix H will be corrected in the final report.

Reviewer:	**City and County of San Francisco, Department of Public Health, Environmental Health (SFDPH) Comments** from Ms. Amy Brownell, P.E., Environmental Engineer	**Date of Comments**	22 November 2017

Item	Review Comment	Navy Response
17	(*SFDPH General Comment #1*) The subject report describes buried radiological objects (or rusted particles that appear to have come from objects) identified and removed at Parcel D-1 during implementation of Phase II Radiological Removal Actions. The objects were in discrete locations in the top two feet of particular, mostly shoreline, areas of Parcel D-1. Based on the wording in this document, it seems that these objects were not part of the original conceptual site model and that the	Section 2.2 addresses the conceptual site model for Hunters Point. Section 2.2.1 includes, as a known and potential source of contamination, the "*burial along with excavated fill materials while increasing the footprint of HPNS*." This identified source would include dredge material containing

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	new theory to account for the objects found and the possibility that other objects may be buried deeper than two feet includes the approximate 1946 shoreline and other details on Exhibit 8-8. The conclusion of this report then attempts to wrap this new conceptual site model into the existing land use and activity restrictions framework that was developed during the CERCLA process for all the other parcels at HPNS. It is also not clear what specific area would be subject to this new conceptual site model. It does not appear that the Navy is proposing that all of the D-1 Phase II Areas or other non-Phase II areas should be subject to this greater than two feet concern. We are not in favor of restrictions being added to areas of Parcel D-1 where there is no evidence to support the need for such restrictions.	radioactive debris that was used to build up the shoreline post-WWII to its present state. Section 8.3 was modified to better explain and provide definition to the Navy's understanding regarding the area impacted by dredge material used to expand the land to its current state: "*Based on the Navy's understanding of how shoreline expansion occurred, that potential [for ROs to be present in material below 2-ft bgs in Parcel D-1 Phase II areas] is largely limited to areas east of the 1946 shoreline. The likelihood of ROs outside that area is considered incidental and of low probability*."
	Parcel D-1, unlike Parcel E-2, Parcel E shoreline and what is now referred to as Lot 2 on IR 7/18, does not include specific restriction language in prior documents for Areas Requiring Institutional Controls for Radionuclides. It is not clear if the Navy wishes to add that type of wording to the documents for Parcel D-1. Or is the Navy proposing a new restriction or new RMP language for this undefined area? Based on our understanding during years of discussion about the framework for the general land use and activity restrictions language that applies to all areas requiring Durable Covers at HPNS, we are not clear that this new conceptual site model can be easily accommodated under the existing restricted activities framework. We would like to discuss this issue and the Navy's proposal, including the aerial extent, to address this new conceptual site model and agree on language to describe this issue in this document. The current language and exhibits do not appear to provide enough detail.	The Navy agrees that areas without potential for ROs should not be restricted. The document has been changed to be consistent with restrictions at Parcels E, E-2, and 7/18.

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Item	Review Comment	Navy Response
18	(*SFDPH Specific Comment #2*) **Executive Summary, Page viii, last paragraph; and Section 8.3, Assessment of Results, page 53, last paragraph; and Section 13.1, Action Memorandum Release Criteria, Page 62**: Please see General Comment #1 and please plan on discussing with us how the current framework of activity restrictions will address these concerns.	Information on land use controls will be addressed separate from the RACR.
19	(*SFDPH Specific Comment #3*) **Section 1.3, Current and Future Reuse, Page 5:** Parcel D-1 includes a portion of the Shipyard South Multi-Use district (includes residential) in addition to HPS Shoreline Open Space area. Please revise the planned use description for Parcel D-1 to: "The future planned use for Parcel D-1 is mixed use residential and shoreline open space as described by the Hunters Point Shipyard Redevelopment Plan (San Francisco Redevelopment Agency, 2010)."	Section 1.3 revised as recommended.
20	(*SFDPH Specific Comment #4*) **Section 3.0, Field Activities Overview**: Section 3.0 states "Gilbane coordinated license responsibilities and management of radioactive material, including waste, with the Navy and other HPNS contractors…" Please identify the contractors referred to by this statement.	Parties to the MOU as of October 2016 were added to Section 3.0. The parties included TetraTech EC, Inc.; B & B Environmental Safety, Inc.; Chicago Bridge & Iron (CB&I); and Gilbane.
21	(*SFDPH Specific Comment #5*) **Section 3.3.1, Radiological Analyses, page 17, paragraph 2:** This section states that "samples for which gamma spectroscopy results indicated the presence of Cs-137 above its release criterion were also	Section 3.3.1, 2nd paragraph, was modified to clarify the samples analyzed for total Sr: "*In addition, with the exception of waste*

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	analyzed for total strontium." Should Field Variance No 003 be identified as an exception? The variance states 10% for pipe sediment samples exceeding the Cs-137 release criterion were selected for conditional Sr-90 analysis.	*characterization samples (e.g., samples collected of sediment in SSSD piping), samples for which gamma spectroscopy results indicated the presence of Cs-137 above its clean-up goal were also analyzed for total strontium*." The rule for analyzing for total Sr based on a Cs-137 exceedance was limited in its application to confirmation samples and was not applied to samples collected for characterizing pipe sediment for waste disposal as well as for informing excavation activities regarding possible contamination due to leakage.
22	(*SFDPH Specific Comment #6*) **Section 3.3.2, Chemical Analyses, page 17, and Sections 9.2 and 9.3, Hazardous Waste and Non-Hazardous Waste, Page 55**: Please summarize the results of the chemical analyses. Please identify comparison criteria and any compounds detected in soil above those levels. Were any chemicals present above the remediation goals established for Parcel D-1? Section 9.2 implies some excavated soil may have been classified as hazardous waste, but does not identify quantity, origin or final disposition. Please clarify and provide these additional details if applicable.	The chemical sampling results of excavated soil are discussed in Section 4.5, including the number of samples exceeding chemical clean-up goals (one sample), the chemical (benzo(a)pyrene), and the resulting volume of excavated soil disposed as hazardous waste (63 m^3). See response to Item 14. A reference to Section 4.5 was added to Section 3.3.2. A second paragraph has been added to Section 3.3.2: " Chemical samples were screened against the remediation goals (RG) for IR Sites presented in the ROD: 11.1 mg/kg for arsenic, 0.33 mg/kg for benzo(a)pyrene, 1.76 mg/kg for

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		benzo(b)fluoranthene, and 6,889 mg/kg for manganese. There were no exceedances, with the exception of sample 04-PD-IR70-003 which exceeded the RG for benzo(a)pyrene at 340 J mg/kg. The associated soil, originating in IR-70, was disposed of as hazardous waste as described further in Section 9.2."
23	(*SFDPH Specific Comment #7*) **Section 3.2, Gamma Walkover Survey, page 15**: Please define the criteria used to identify "potential for elevated residual radioactivity" during gamma walkover surveys.	The sentence was modified to state, "*A gamma walkover survey (GWS) was performed prior to sampling to identify locations with the highest potential for elevated residual radioactivity based on their measured levels of gamma radiation*."
24	(*SFDPH Specific Comment #8*) **Section 3.3.3, Data Assessment, page 17**: Please identify entity or entities performing data quality assessment and verification. Please summarize the results of data quality verification activities. For example, please provide a summary of the results of the gamma walkover survey verification activities. Does evaluation of the position-correlated measurement data confirm adequate coverage and adherence to set speeds? In regards to laboratory data, please provide a summary of key findings of the quality control summary reports.	Information was added to Section 3.3.3 that describe the entities who performed the data assessment activities: "*A combination of project team members from Gilbane and two of its subcontractors, Envirachem and timmy's Team, including the Project Manager, Data Manager, Project Chemist, and Certified Health Physicist, performed the data assessment of the GWS data. The data assessment activities are summarized in Section 3.2 and presented in the respective project reports (Gilbane, 2016a through e, and 2017a and 2017b). An independent third-party validation*

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		company, Environmental Synectics, Inc. (Synectics) of Sacramento, California, performed a manual EPA Level III review on approximately 80 percent of the sampling events, and an EPA Level IV data validation on the remaining 20 percent of the results..." An extensive summary of key findings of the quality control summary reports was added to Section 3.3.3. In addition, a discussion of GWS data verification activities was added to Section 3.2: "*Collected data were retrieved from the RS-700 and processed using numerical and graphical methods. First, the data were plotted to ensure adequate scan coverage. A tractor speed histogram was developed using the position-correlated data as a quality control check to verify the proper speed of the detector over the ground. The data were checked for errors as well as examined for potential outliers and other anomalous features. Descriptive statistics (e.g., range, median, mean, and standard deviation) were used to assess the data set. The data were graphed on a cumulative frequency diagram to test departure from normality and to reveal characteristics of the data distribution such as dissimilar populations and data set outliers that may not be apparent otherwise*."

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Item	Review Comment	Navy Response
25	(*SFDPH Specific Comment #9*) **Section 4.5, Radiological Screening Yard Operations, page 25, third paragraph:** Please define point source.	To improve clarity, the term '*point sources'* was replaced with '*discrete radioactive objects*.'
26	(*SFDPH Specific Comment #10*) **Section 4.6, Removal of Piping and System Components, pages 27 and 28:** The last sentence of page 27 indicates that non-soil material encountered during excavation "such as radioactively contaminated sand blast grit; fire brick; and drums, bottles, jars, and small containers with unknown content" were not sent to the radiological screening yard. Please confirm whether these items were in fact identified. If so, please identify the objects' origins, characterization, and final disposition (e.g., off-site disposal as LLRW).	A sentence was added to Section 4.6 stating, "*Material that was identified as radioactive waste was handled as described in Section 9.1*." Since only a general inventory of items other than discrete radioactive objects was maintained, the specific items that were identified and disposed of as LLRW cannot be confirmed. The listed examples of specific non-soil material (i.e., radioactively contaminated sandblast grit; firebrick; and drums, bottles, jars, and small containers with unknown contents) was deleted.
27	(*SFDPH Specific Comment #11*) **Section 4.10, Site Restoration, page 31, last sentence**: Please include a reference to Section 8.0. Also, please describe the final disposition of the RSY soil that was "scooped up".	A reference to Section 8.0 was added. In addition, the following description was added to Section 4.10, 2nd paragraph: "*The RSY pads were surveyed and sampled, then scooped up. Once determined to be non-LLRW, the pad material was removed and transferred to the Navy's basewide hazardous waste contractor for waste characterization and appropriate disposal*."

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28	(*SFDPH Specific Comment #12*) **Section 5.5, Results and Analysis, Page 35, last paragraph and Section 6.4, Results and Analysis, Page 39, last paragraph**: See General Comment #1. Referenced Section 8.3 needs to better describe the aerial [areal] extent and the exact details of the Navy's proposal.	Section 8.3 was modified to better explain and provide definition to the Navy's understanding regarding the area impacted by dredge material used to expand the land to its current state: "*Based on the Navy's understanding of how shoreline expansion occurred, that potential [for ROs to be present in material below 2-ft bgs in Parcel D-1 Phase II areas] is largely limited to areas east of the 1946 shoreline. The likelihood of ROs outside that area is considered incidental and of low probability*." Exhibit 8-8 was revised accordingly. Information on land use controls will be presented separate from the RACR.
29	(*SFDPH Specific Comment #13*) **Section 7.0, Railroad Tie Survey and Disposal, page 40**: Please provide a "Description and Background" section similar to that provided for the other Phase II investigation areas. It is unclear why railroad ties were investigated as potentially radiologically impacted.	A new Section 7.1 was added: "*Salvaged creosote railroad ties collected over time from various areas across HPNS were stockpiled in two locations in Parcel D-1: (1) the southern portion of Parcel D-1 near Ship Berths 22 and 29, and (2) at the head of Gun Mole Pier adjacent to Berth 14, as shown in Exhibit 1-2. The estimated 12,000 used railroad ties existed in various deteriorated states. Since they were considered radiologically impacted, the railroad ties required some form of radiological survey and sampling in order to achieve the Navy's goal of releasing them from*

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		radiological controls and disposing them as non-LLRW."
30	(*SFDPH Specific Comment #14*) **Exhibit 8-8, Locations where Discrete Radioactive Objects were Recovered, page 52 and Section 8.3, Assessment of Results, page 53**: The last paragraph states "…there is the potential for ROs to be present in material below 2 ft bgs in Parcel D-1 Phase II areas where shoreline expansion occurred in Parcel D-1 since 1946 (i.e., where dredge material from the Bay was used to create the present shoreline)." Please clearly identify this area on Exhibit 8-8 and label as "Area with Potential for Buried ROs." Was dredge material used elsewhere in Parcel D-1/other parcels inland of the 1946 shoreline? We note that Exhibit 8-8 shows ROs inland of the historic shoreline. Exhibit 8-8 needs to be revised or a new figure needs to be created to address the concerns in Comment #1.	Dredge spoils were used to expand the land present in 1946 to its current state in Parcel D-1. The ROs found inside of the 1946 shoreline are consistent with the conceptual site model of dredge spoils. Section 8.3 was modified to better explain and provide definition to the Navy's understanding regarding the area impacted by dredge material used to expand the land to its current state as follows: "*Based on the Navy's understanding of how shoreline expansion occurred, that potential [for ROs to be present in material below 2-ft bgs in Parcel D-1 Phase II areas] is largely limited to areas east of the 1946 shoreline. The likelihood of ROs outside that area is considered incidental and of low probability* ". Exhibit 8-8 was revised accordingly. Information. Information on land use controls will be presented separate from the RACR.
31	(*SFDPH Specific Comment #15*) **Section 13.2, Dose and Risk Modeling, Page 63, last paragraph**: See Comment #1. It is not clear how the existing restricted activity framework will address the concepts described in this paragraph.	Information on land use controls will be presented separate from the RACR.

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RESPONSE TO COMMENTS ON DRAFT FINAL			
Reviewer:	**City and County of San Francisco, Department of Public Health, Environmental Health (SFDPH) Comments** from Ms. Amy Brownell, P.E., Environmental Engineer	**Date of Comments**	6 February 2018

Item	Review Comment	Navy Response
32	(*SFDPH Comment #1 - Response to General Comment 1 and Modifications Requested based on review of the Draft Final Document*): For SFDPH General Comment #1 and Specific Comments #2, #14 and #15, your response has referenced information on land use controls that will be presented separate from the RACR. We appreciate that the Navy has held additional discussions with us about the 1946 shoreline in this area. We understand that the Navy attributes the presence of radiological objects (ROs) in fill material below two feet to the post-WWII placement of dredge material containing radioactive debris. This information is important and explains the discovery of discrete ROs around the 1946 shoreline. As you have explained, the potential presence of ROs near the 1946 shoreline on Parcel D-1 will result in a subsequent document with an opportunity for review and comment (e.g. possibly a Memo to File) that will define required activity restrictions based on the possibility of buried radioactive objects below two feet. Since activity restrictions are part of Institutional Controls which are part of the remedy, it seems that the FFA Signatories cannot approve that this Remedial Action and RACR are complete, unlike all prior parcels where the Institutional Control framework was complete and agreed to by all parties prior to final RACR approval. We request that the area requiring institutional controls/land use controls be clearly shown on a figure in this document and then further defined in the referenced future document and that the future document acknowledge	Section 13.3, last paragraph, was modified to state, "*Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the LUC RD (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs*." Exhibit 8-8 was modified to show the area requiring institutional controls (ARIC). The area is slightly larger than the 1946 shoreline

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	uncertainties related to placement of dredge material containing radiological debris. Should the area be slightly larger than the 1946 shoreline and extend to cover to the southwest where ROs have been found or possibly extend to the Parcel D-1/Parcel E boundary? As we stated in previous comments, we are not in favor of a restriction over a wide area solely based on the lack of information. But in this case, there is uncertainty in the exact areal extent of the concern even with the information available. Specifically, the following uncertainties may be helpful in evaluating an appropriate boundary for the ARIC: (1) The Navy has not provided enough supporting information to define the fill placement depth pre- vs. post-use of ROs. Fill is present up to 34 feet thick at IR-53 around Buildings 525 and 530 (near RO-01, -02, and -09) as provided in the Parcel D Remedial Investigation Report and the depth at which ROs may be present is uncertain. This RACR states that "HPNS began using radioactive materials in shipyard operations and NRDL research projects in the early 1940s" and that the "surface of Parcel D-1 is fill and was constructed between approximately 1942 and 1947"; did the material placed pre-1946 include material other than dredge material?; (2) The radiological objects found land-ward of the approximate 1946 shoreline are not only found on the surface (i.e., < 0.5 feet bgs). Rather, the ROs are found up to 2 to 3 feet bgs, which is comparable in depth to those objects found bay-ward of the 1946 shoreline; (3) The accuracy of the approximate 1946 shoreline may vary based on the quality of the referenced aerials; and (4) The Navy cites grading of dredge material as "a ready explanation for the discovery of ROs outside of, but adjacent to, the 1946 shoreline."	approximation and includes the southwest area where ROs were found. Additional information regarding the basis for the ARIC was added as Section 8.3.2.
	In support of drawing the restriction line close to but not exactly on your currently presented 1946 shoreline, we recommend the following revisions to the Navy's proposed text: "Based on the Navy's understanding of how	The text, now found in Section 8.3.1, 4th paragraph, was modified as recommended. Similar text found in the Executive Summary and

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	shoreline expansion occurred, ~~that~~ [the] potential for ROs to be present in material below 2-ft bgs in Parcel D-1 Phase II areas is largely limited to areas ~~east of~~ [around] the 1946 shoreline. The likelihood of ROs ~~outside that area~~ [moving away from the 1946 shoreline] is considered incidental and of low probability."	in Section 13.3 was also modified as recommended.
32	(*SFDPH Comment #2 – Request for Regulatory Agencies)* We urge the FFA Signatories to provide conditional approval of this RACR, once their concerns have been addressed, pending the subsequent document that will finalize the needed activity restrictions (i.e., the RACR is automatically deemed approved once the subsequent document is approved). In our opinion, the remedy isn't complete until all aspects, including activity restrictions, are defined and the framework for implementation is complete.	Noted. Section 13.3, last paragraph, was modified to state, "*Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the LUC RD (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs*."
33	(*SFDPH Comment #3 – Response to Specific Comment #6, Section 3.3.2, Chemical Analyses, page 17, and Sections 9.2 and 9.3, Hazardous Waste and Non-Hazardous Waste, Page 55)* The Navy's Response addresses specific comment #6; however, given the detection of benzo(a)pyrene at 340 J mg/kg, we are curious if the Navy confirmed the origin of the soil and whether the area is already being addressed under a chemical remedial action or a petroleum program remedial action?	The Navy has done hot spot removals in the past as remedial action in Parcel G. The exceedance identified in IR-70 was based on three samples collected with results for benzo(a)pyrene reported as 0.26, 0.28, and 0.34 mg/kg. The soil was disposed as hazardous waste and clean fill brought in has backfill, which effectively served as a remedial action in response to the elevated chemical of concern.
34	(*SFDPH Comment #4 – Section 3.2, Gamma Walkover Survey, page 15)* The Navy's response is adequate to explain the purpose of the survey but it doesn't address our comment. Our comment is asking what measurement	A sentence was added to Section 3.2, 2nd paragraph stating, "*Locations with measurements greater than three standard deviations above the*

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	(i.e. what number) the Navy uses as the comparison criteria "to identify locations with the highest potential for elevated residual radioactivity"?	*data set mean were routinely selected for biased sampling*."
35	(*SFDPH Comment #5 – Section 8.3 Assessment of Results, Exhibit 8-8, Page 55)* Please label the fuchsia dotted line as the 1946 shoreline.	Exhibit 8-8 was modified to label the fuchsia dotted line as the 1946 shoreline approximation.
36	(*SFDPH Comment #6 – Section 13.3, Discrete Radioactive Objects, page 67)* Section 13.3 states "Implementation of land use and activity restrictions as prescribed by the ROD (Navy, 2009) and further detailed by the Land Use Controls Remedial Design in the Final Design Basis Report For Parcel D-1, Hunters Point Naval Shipyard, San Francisco, California (ChaduxTt, 2011), which prohibit land-disturbing activities throughout Parcel D-1, will appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs." Please see comment 1 and please either delete this statement or modify this statement to reference a subsequent document that will define required activity restrictions based on the possibility of buried ROs below two feet. As written, the Navy's statement is referencing an activity restriction that is only one tiny piece of the framework that allows for redevelopment to happen while "appropriately mitigat[ing] any risk to human health". The referenced activity restriction is part of a framework, that includes a Risk Management Plan, that requires no extra soil handling procedures other than those listed in the Risk Management Plan which are similar to normal construction soil handling protocols. There are no handling protocols in that framework to "address the potential for ROs in subsurface below 2 feet" as stated in your RTCs. If you want to reference this particular activity restriction then you must also reference the future activity restrictions that your	Section 13.3, last paragraph, was modified to state, "*Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the LUC RD (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs*." See response to first part of comment above.

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	Response to Comments says you are going to present separate from this RACR because those are going to be the activity restrictions, based on your RTC's, that will apply to this area bayward of the 1946 shoreline.	
37	(*SFDPH Minor Comment #1 – Section 1.2, Scope of Work, Page 5)* Please delete the end of this sentence as follows: "This radiological RACR does not address chemical contamination ~~and does not include or affected any other designated HPNS parcels~~."	Section 1.2, last paragraph, was modified as recommended.

Reviewer:	**California Department of Toxic Substances Control (DTSC) Comments** from Ms. Juanita Bacey, Project Manager, Brownfields & Environmental Restoration	**Date of Comments**	Email correspondence dated 8 February 2018

38	Please note that CDPH EMB previously indicated that a recommendation for unrestricted release (RURR) will not be provided to those areas along the shoreline where soils below a depth of 2 feet were not investigated for ROCs (NRDL Area and Ship Berths 14, 21, 22, 29). Currently, the Executive Summary and Sections 8.3 and 13.3 of the Draft RACR indicate that land use and activity restrictions as indicated in the 2009 ROD or that are already in place will mitigate any risk to human health and prohibit land disturbing activities. The ROD land use restrictions are to address COCs left in place throughout the base, not ROCs. DTSC recommends revising these sections to indicate that additional restrictions to address ROCs in soil below 2 feet will be added to the land use restrictions already prescribed in the ROD (similar to those for IR07/18).	The wording in the cited sections was modified to read as follows: "*Land use and activity restrictions that are currently in place prohibit land-disturbing activities throughout Parcel D-1 in the interim until the Land Use Controls Remedial Design in the Final Design Basis Report For Parcel D-1, Hunters Point Naval Shipyard, San Francisco, California (ChaduxTt, 2011) is amended to appropriately mitigate any risk to human health relating to the potential presence of ROs in material below 2 ft bgs*."

Reviewer:	**US Environmental Protection Agency (EPA) Comments** from Ms. Lily Lee, Remedial Project Manager	**Date of Comments**	Email correspondence dated 9 February 2018

38	*(Evaluation of the Response to Item 10, EPA General Comment #6)* The	Section 4.7, 5th paragraph, 1st sentence was

	response partially addresses the comment. Specifically, the proposed revised text does not clarify which sample results were averaged. For example, it is unclear if only post-remediation confirmation samples were averaged for inclusion in the RESRAD dose and risk modeling or if bias sample results were included as well. Please revise the proposed text to specify the sample results that were averaged for the RESRAD dose and risk modeling.	modified to state, "*Dose and risk modeling of the trench surfaces was performed in RESRAD using the analytical results of samples collected from both systematically-spaced and biased locations representing post-remediation or 'as-left' trench surfaces*."

Reviewer:	**California Department of Public Health (CDPH) Comments** via email from Ms. Juanita Bacey of DTSC (This review was performed in support of the Interagency Agreement between DTSC and CDPH.)	**Date of Comments**	Email correspondence dated 26 April 2018

39	**(CDPH Specific Comment #1) – in reference to Navy response to Item #4:** Navy Response, Review Comment, Item number four, sentence number three; "Unrestricted release request and no further action recommendation for removed SSSD lines are warranted, because none of the SSSD trenches were located within the 1946 shoreline expansion area as potential for RO is limited only within the 1946 shoreline." An overlay of Exhibit 1-2, "Parcel D-1 Site Features Involving Phase II Removal Actions", on top of Exhibit 8-8, "Locations where Discrete Radioactive Objects were Removed", apparently shows multiple Sanitary Sewer and Storm Drains (SSSD) located whole and in part in the area labeled as, "Historical 1946 Shoreline". Please explain.	Exhibit 8-8 was modified to show the location of SSSD trenches within the 1946 shoreline area and the response to Item #4 was modified to read, "*Unrestricted release request and no further action recommendation for removed SSSD lines are warranted except for those SSSD trenches located within the 1946 shoreline expansion area*."
40	**(CDPH Specific Comment #2) – Exhibit 8-8:** It is not clear to the reader if the blue hatched area marked as, "Restriction related to radioisotopes", on Exhibit 8-8, "Locations where Discrete Radioactive Objects were Removed"; is the same area(s) as the, "buffer zone", referred to in page 57, paragraph one, sentence five. Please clarify.	The legend in Exhibit 8-8 was modified to call the cross-hatching the '*Area Requiring Institutional Controls*.' A sentence was included in the new Section 8.3.2 that states, "*Therefore, a buffer zone extending beyond the 1946 shoreline approximation is included with the 2 ft bgs restriction for Parcel D-1 Phase II, which is referred to as the area requiring institutional*

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		controls (see Exhibit 8-8)."
41	**(CDPH Specific Comment #3) – in reference to Navy response to Item #4:** Navy Response, Review Comment, Item number four, sentence number four: "A couple of ROs recovered outside of the 1946 shoreline expansion area within the trench excavation zones are incidental and the likelihood of ROs outside that area is considered incidental and of low probability."	
	a. Please note that the sentence number three states, "...as potential for RO is limited only within the 1946 shoreline." Please resolve apparent contradiction.	Sentences were modified to read, "*…the potential is largely limited to areas around the 1946 shoreline (Exhibit 8-8). The likelihood of ROs moving away from the 1946 shoreline is considered incidental and of low probability*."
	b. Of particular concern are RO-03 and RO-04; which according to Exhibit 8-7, "Recovered Radioactive Objects Data", page 54, are deck markers recovered from Trenches #04-PD-015, Zone O, and #04-PD-016, Zone P, respectively. These ROs are solid deck markers; and therefore cannot be considered effusions from the SSSD line which was removed. Please present a Conceptual Site Model (CSM) which explains the presence of solid deck markers ROs outside the Historical 1946 Shoreline.	A new Section 8.3.2, entitled, '*Conceptual Site Model*,' was added to explain the presence of ROs outside the historical 1946 shoreline approximation.
	c. A review of, "Exhibit 8-8, "Locations where Discrete Radioactive Objects were Removed", shows seven Radiological Objects (ROs) located inside "Historical 1946 Shoreline", while six ROs are located outside of "Historical 1946 Shoreline". This may be more accurately stated as rough equivalency of 54 percent to 46 percent. Please present Conceptual Site Model (CSM) which explains the presence of ROs outside the Historical 1946 Shoreline.	A new Section 8.3.2, entitled, '*Conceptual Site Model*,' was added to explain the presence of ROs both inside and outside the historical 1946 shoreline approximation.

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NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REPORT
FINAL STATUS SURVEY: SHIP BERTHS 14, 21, 22, & 29
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

APRIL 2019

STATEMENT A – Approved for public release; distribution is unlimited

DCN: ITSI-0808-0004-0074

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NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
SAN DIEGO, CALIFORNIA

FINAL REPORT
FINAL STATUS SURVEY: SHIP BERTHS 14, 21, 22, & 29
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

APRIL 2019

Prepared for NAVFAC Southwest by:

Gilbane Federal
1655 Grant Street, Suite 1200
Concord, California 94520

Contract Number N62473-10-D-2227
Contract Task Order 0004
Document Control Number: ITSI-0808-0004-0074

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Technical Memorandum

To:	Danielle Janda, Navy Lead Remedial Project Manager
From:	Jerry Cooper, Gilbane Principal Health Physicist
Date:	November 21, 2018
Subject:	Technical Approach: Elevated Alpha Surface Activity on Weathered Outdoor Metal Surfaces; Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard (Revision 1)
Contract/TO:	N62473-10-D-0808 / CTO 0004 **Gilbane Project No.:** J204000400

In performing radiological surveys of ship berths at HPNS, Gilbane has encountered elevated alpha activity in the range of 100 to 400 dpm/100 cm^2 on the surfaces of various weathered outdoor metal surfaces, particularly pier components, which cannot be readily explained by radon and is not suspected to be due to contamination. The release criterion for ship berth-related alpha activity is 100 dpm/100 cm^2.

Background

The *Historical Radiological Assessment* (NAVSEA, 2004) determined that the ship berths at HPNS were radiologically impacted primarily as the result of Operation Crossroads decontamination efforts and secondarily due to the possibility of radium devices existing in the area. The radionuclides of concern for the ship berths are Sr-90, Cs-137, Ra-226, and Pu-239. Of particular interest here are the alpha-emitting radionuclides of concern Ra-226 and Pu-239. For simplicity in execution, residual radioactivity on structure surfaces measured as gross alpha activity is assumed to be either Ra-226 or Pu-239, unless isotopic analysis is performed or a technical basis for an alternate approach is documented and approved for use by the Navy. Based on this assumption, the measured alpha activity on the pier components exceeds the release criterion for alpha activity.

Elevated alpha activity consistently has been found on or near heavily weathered (i.e., rusted) metal surfaces. Previous studies have ruled out radioactive contamination from Ra-226 or Pu-239, radon accumulation/build-up, and removable surface activity as the source of the elevated alpha activity. It has been suspected to be the result of a paint component or a physical phenomenon such as static charge build-up from wind. Regardless, no definitive answer has been developed as to the source of the elevated alpha surface activity and how it should be handled.

Research has identified another possible source of elevated alpha activity as electrostatic charge attracting radon progeny, specifically Po-210. The plate-out of Po-210 on outdoor metal structures has been confirmed at several DOE sites (Abelquist, pgs. 197, 198). The Po-210 deposition is readily observable primarily on galvanized metal surfaces or metal that is rusty, oxidized, or weathered and is possibly due to electrostatic charge. Other radon progeny does not appear to adhere and accumulate as does Po-210.

Method

Building upon previous studies (TetraTech EC, 2013), Gilbane collected samples of metallic shavings, rust particles and paint scraped from four bollards located at Ship Berth 14. Scrapings were collected from a 100 cm^2 area of elevated alpha activity (i.e., ranging from 200 to 300 dpm/100 cm^2) on the top of each bollard. Figure 1 shows a representative bollard from Ship Berth 14 before and after a sample of scrapings is collected.

Figure 1 – Photo of Representative Bollard Before and After Scraping Sample Collected

Measurements of total alpha surface activity were taken before and after each scraping was collected to verify the alpha activity was captured in the scrapings themselves (see attached radiological survey). The measurements are summarized in Table 1. Surface measurements were taken with a Ludlum Model 43-93 100-cm^2 zinc sulfide (silver activated) dual phosphor scintillation detector coupled to a Ludlum Model 2360 alpha/beta dual-channel scaler.

Table 1 – Total Alpha Surface Activity Measurements

Sample Location	Alpha Activity (dpm/100 cm^2)	
	Before Sampling	After Sampling
Bollard #1	218	23
Bollard #2	251	17
Bollard #3	264	17
Bollard #4	348	23

The scrapings from the four bollards were combined into a single composite sample. The sample was sent to ARS International, LLC, in Port Allen, Louisiana, for analysis consistent with the sampling and analysis plan appended to the *Execution Plan for Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California* (ITSI Gilbane, 2013). ARS is accredited under the DoD Environmental Laboratory Accreditation Program and the CDPH National Environmental Laboratory Accreditation Program. Five types of analyses, listed in Table 2 below, were performed.

Table 2 – Laboratory Sample Analyses

Analytical Method	Method Number
Gamma Spectroscopy	ARS-007/EPA 901.1M
Gross Alpha/Beta	ARS-003/EPA 900.0M
Isotopic Pu by Alpha Spectroscopy	ARS-026/Eichrom ACW-03
Po-210 by Alpha Spectroscopy	ARS-034/HASL-PO-01 RC
Sr-90 by Gas Flow Proportional Counting	ARS-032/Eichrom SRW01

Discussion of Results

The laboratory analytical results (see attached laboratory report) are summarized in Table 3. Radionuclides listed with no reported activity were not detected as present in a concentration above the

sample MDC. K-40 is naturally occurring and is found throughout nature wherever there is potassium. Be-7 is formed in the atmosphere and deposits onto the earth's crust. The presence of both Cs-137 and Sr-90 in the sample is not necessarily indicative of contamination from legacy Navy operations. Both are fission products that are routinely encountered in the environment as a result of the atmospheric testing of nuclear weapons. The ratio between Cs-137 and Sr-90 are consistent with background levels associated with the aforementioned atmospheric testing of nuclear weapons (Shapiro, pg. 263). Pb-210 and Pb-214 are progeny of Rn-222. Pb-214 is minutes removed from the decay of Rn-222 and Pb-210 with its 22 year half-life, once present, dissipates slowly.

Table 3 – Laboratory Analytical Results

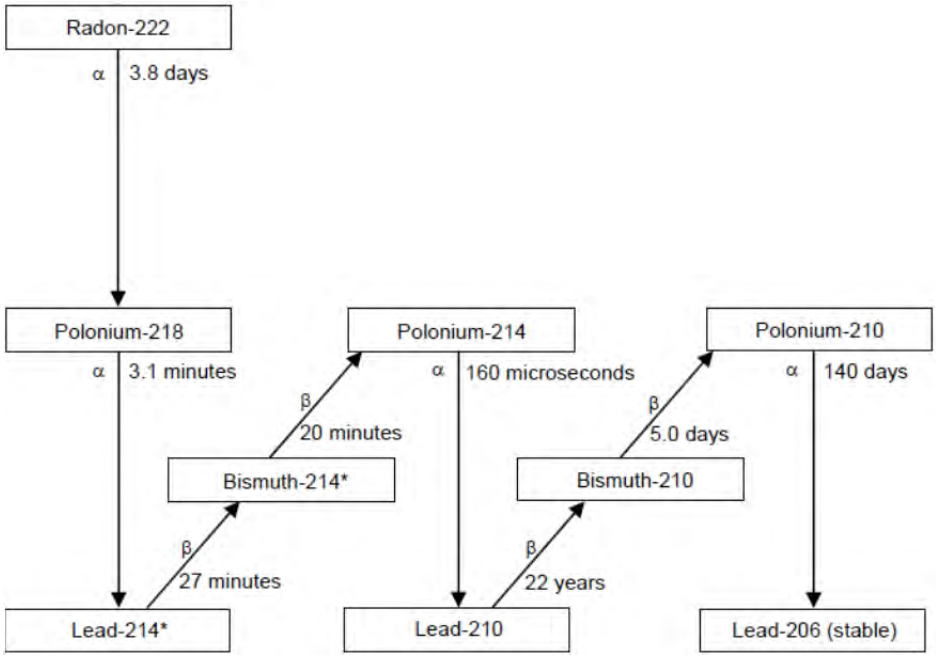
Analytical Method	Analyte	Activity (pCi/g)	Uncertainty (pCi/g)	MDC (pCi/g)	Decay Mode
Gamma Spectroscopy	Be-7	2.821	1.048	1.010	β
	K-40	2.248	1.063	1.770	β
	Co-60	---	0.209	0.147	β
	Cs-137	0.947	0.190	0.158	β
	Eu-152	---	0.170	0.282	β
	Eu-154	---	0.095	0.159	β
	Tl-208	---	0.146	0.180	β
	Pb-210	9.876	1.985	2.020	β
	Bi-212	---	1.880	2.180	α/β
	Pb-212	---	0.132	0.203	β
	Bi-214	---	2.089	1.120	β
	Pb-214	0.328	0.192	0.324	β
	Ra-226	---	1.372	2.290	α
	Ra-228	---	0.325	0.588	β
	Pa-234	---	2.604	1.360	β
	Th-234	---	0.000	2.500	β
	U-235	---	0.433	0.592	α
	U-238	---	0.000	1.860	α
	Am-241	---	0.110	0.184	α
Gross Alpha/Beta	Gross Alpha	24.684	6.848	4.233	α
	Gross Beta	24.345	5.913	1.855	β
Isotopic Pu	Pu-238	---	0.101	0.219	α
	Pu-239/240	---	0.159	0.295	α
Po-210	Po-210	19.743	1.725	0.044	α
Sr-90	Sr-90	0.519	0.342	0.241	β

Neither Ra-226 nor Pu-239 was detected as present in the sample. Therefore, a conclusion can be made that the elevated alpha surface activity is not due to contamination by alpha-emitting radionuclides of concern. The only alpha-emitting radionuclide detected above the sample MDC was Po-210, whose activity accounts for 80% of the reported gross alpha activity (i.e., 19.743 ÷ 24.684 = 0.800).

Figure 2 shows the natural decay series for radon. Radon decay products are various isotopes of Po, Pb, and Bi. Of these isotopes, those with the longest half-lives are Pb-210 (22 years) and Po-210 (140 days). The rest have half-lives less than 30 minutes and therefore disappear rapidly when removed from the radon feeder source. As radon decays, its electrically charged progeny attach themselves to dust particles, which deposit themselves on horizontal surfaces, such as the top of pier components. If the presence of Po-210 was solely due to this, then sample results would have shown the several Po, Pb, and Bi isotopes to be present in similar concentrations in some form of secular equilibrium. But this is not the case. Po-210 parent radionuclides are not present in similar concentrations. So then, the presence of Po-210 at

concentrations much higher than its parent radionuclides is consistent with plate-out of Po-210 on outdoor metal structures as has been confirmed at other sites.

Figure 2 – Radon Decay Series



Conclusion

The presence of Po-210 is not unexpected due to radon decay in the environment and its long half-life (140 days) relative to other radon progeny. The plate-out of Po-210 on outdoor metal structures is a recognized phenomenon that is readily observable primarily on galvanized metal surfaces or metal that is rusty, oxidized, or weathered. As analytical results indicate, Po-210 clearly is the dominant alpha-emitter present in the scraping sample collected from a series of bollards in Ship Berth 14. Po-210 activity composes 80% of the measured gross alpha activity in the sample.

Therefore, once this technical memorandum is approved for use by the Navy, total alpha surface activity measurements of weathered outdoor metal surfaces, such as pier components at HPNS, will be multiplied by a correction factor of 0.2 to remove the alpha activity contribution from the plate-out of Po-210.

Other than Po-210, the several radionuclides listed in Table 3 with reported activity are naturally occurring beta-emitters. A case could be made for a correction factor for beta activity. However, Gilbane has not encountered problems with elevated beta activity above the release criteria and does not believe there is a need for a beta correction factor at this time.

References

Abelquist, Eric W. *Decommissioning Health Physics: A Handbook for MARSSIM Users, Second Edition*. CRC Press, New York. 2014.

ITSI Gilbane, 2013. ITSI Gilbane, 2013b. Execution Plan: Parcel D-1 Phase II Radiological Remediation and Support, Hunters Point Naval Shipyard, San Francisco, California. Final. July.

Naval Sea Systems Command (NAVSEA), 2004. *Historical Radiological Assessment, Hunters Point Annex, Volume II, History of the Uses of General Radioactive Material 1939–2003.* Final. August.

Shapiro, Charles S. *Atmospheric Nuclear Tests: Environmental and Human Consequences.* Springer-Verlag, New York. 1998.

Attachments

HPNS Radiological Survey No. 07204.0004-1107-SBCH, dated 06 Aug 2014, ITSI Gilbane.

Laboratory Analysis Report ARS1-14-01921, ARS International, LLC, Port Allen, Louisiana.

Gilbane

RADIOLOGICAL SURVEY FORM

CONTRACT NO / TO NO: N62473-10-D-0808	PROJECT TITLE / LOCATION: Rad Remediation D-1, Phase II / HPNS	ITSI GILBANE PROJECT NO: 07204.0004

Survey No.: 07204.0004-1107-SBCH	Date: 8/6/2014	Location: SB 14	Survey Type: SBCH
Danny Bulilan	D. A. Pulos	Ed Palser	
Tech Printed Name	Signature	RSO Printed Name	Signature

Instrument(s)

Model	Serial	Cal Due Date	Probe Model	Probe Serial	Cal Due Date	BKG α	BKG β	BKG γ	BKG µr/Hr	Eff. α	Eff. β
2360	278618	8/29/2014	43-93	PR311163	8/29/2014	0.2	137.1	N/A	N/A	0.08	0.11

Ship Berth 14

7/22/2014	1	Bollard # 1 Before
	2	Bollard # 1 After
	3	Bollard # 2 Before
	4	Bollard # 2 After
	5	Bollard # 3 Before
	6	Bollard # 3 After
	7	Bollard # 4 Before
	8	Bollard # 4 After

EXAMPLE - Bollard Prior to Sanding

EXAMPLE - Bollard After Sanding

Comments: See Attached Page for Removable Results.

2360 BKGD taken from instrument set up sheet (2 minute).

Direct static readings were collected at each sample location before the sample media was removed and immediately after. No swipes were taken, see volumetric annalytical data for details.

Gilbane			RADIOLOGICAL SURVEY FORM
CONTRACT NO / TO NO: N62473-10-D-0808	PROJECT TITLE / LOCATION: Rad Remediation D-1, Phase II / HPNS		ITSI GILBANE PROJECT NO: 07204.0004
Survey No.: 07204.0004-1107-SBCH	Date: 8/6/2014	Location: SB 14	Survey Type: SBCH

#	Gross β/γ	Net β/γ (dpm/100 cm^2)	Gross α	Net α (dpm/100 cm^2)	μR/Hr	Location
0001	354	352	34	218	7	# 1 Before
0002	254	-89	4	23	7	# 1 After
0003	298	105	39	251	7	# 2 Before
0004	219	-243	3	17	7	# 2 After
0005	349	330	41	264	7	# 3 Before
0006	229	-199	3	17	7	# 3 After
0007	378	457	54	348	7	# 4 Before
0008	204	-309	4	23	7	# 4 After
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Comments: Gross Static Results Are 2 Min. Counts.

Release Limits: Removable **α 20 dpm/100cm2** **β 200 dpm/100cm2**

Total **α 100 dpm/100cm2** **β 1000 dpm/100cm2**

Technician Name Print: Danny Bulilan

Technician Name Signature: D. J. Bulilan Date: 8/6/2014

Reviewed by: Date: 8/6/2014

Gilbane

SCALER INSTRUMENT SET-UP WORKSHEET

Contract Number / Task Order Number:	Project Title / Location:	ITSI Gilbane Project Number:
N62473-10-D-0808 / 0004	Parcel D1 Phase II / Hunters Point Naval Shipyard	7204.0004

Source Response: **Beta**

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Instrument / SN: 2360/278618 **Cal. Due:** 29-Aug-14
Probe Type / SN: 43-93/PR311163 **Cal. Due:** 29-Aug-14
Technician: C. Bryson
Location: HPNS

Setup Date: 08-Jul-14
Source Cert. Date: 15-Sep-13
Source SN: K7-321
Surface Emission Rate: 27,870 particles/min
Source Type: Tc-99
HV Check/Setting: 800

1. Total Background Counts observed:

Chi-squared Calculations

1	249	-25.2	632.5
2	291	16.9	283.9
3	246	-28.2	792.4
4	268	-6.1	37.8
5	278	3.9	14.8
6	317	42.9	1836.1
7	282	7.9	61.6
8	272	-2.1	4.6
9	298	23.9	568.8
10	262	-12.2	147.6
11	279	4.9	23.5
12	232	-42.2	1776.6
13	251	-23.2	535.9
14	284	9.9	97.0
15	233	-41.2	1693.3
16	296	21.9	477.4
17	308	33.9	1145.8
18	248	-26.2	683.8
19	312	37.9	1432.6
20	277	2.9	8.1
		0	

Background Count Time: 2 minutes
Source/Sample Count Time: 2 minutes

Average Counts = 274.2 counts

Average Count Rate = 137.1 cpm

Standard Deviation = 25.4 counts

Sum of Squares = 12,255

Area Correction Factor (ACF) = 1.00 $100cm^2$

Scan Observation Interval = 1.00 sec

2. Total Source Counts observed:

Chi-squared Calculations

1	12,700	-224	50,086
2	12,894	-30	888
3	12,801	-123	15,080
4	12,803	-121	14,593
5	12,831	-93	8,612
6	13,210	286	81,910
7	13,204	280	78,512
8	12,833	-91	8,245
9	12,895	-29	829
10	12,944	20	408
11	13,057	133	17,742
12	12,863	-61	3,697
13	12,941	17	296
14	12,873	-51	2,581
15	12,896	-28	773
16	12,974	50	2,520
17	13,002	78	6,115
18	12,923	-1	1
19	12,894	-30	888
20	12,938	14	202
		0	

Average Counts = 12,924 counts

Average Count Rate = 6,462 cpm

Standard Deviation = 124 counts

Sum of the Squares = 293,977

Chi-Squared Statistic = 22.75

Acceptable Ranges for Chi-x^2
8.91 to 32.85
(assumes n-1 degrees of freedom; two-tailed distribution @ 95% confidence level)

Net source cts = 12,650 counts
Std. Dev. Net = 127 counts
Net Ct. Rate = 6,325 cpm

Instrument Efficiency (E_i) = 0.2269 cpm/dpm
Surface Efficiency (E_s) = 0.5000 cpm/dpm
Total Efficiency (E_T) = 0.1135 cpm/dpm

MDCR = 125 cpm (@ 95% confidence level)

MDA Scan= **1,559.79** **dpm/100 cm^2**
MDA Static= **493.29** **dpm/100 cm^2**

Bkg count range 223 to 325 (2 sigma)
Source count range 12,675 to 13,173 (2 sigma)

Technical Reviewer

7-8-14
Date

Gilbane

SCALER INSTRUMENT SET-UP WORKSHEET

Contract Number / Task Order Number:	Project Title / Location:	ITSI Gilbane Project Number:
N62473-10-D-0808 / 0004	Parcel D1 Phase II / Hunters Point Naval Shipyard	7204.0004

Source Activity Correction Worksheet

Isotope	Tc-99		
ID #	K7-321		
Initial Activity (dpm)	27,870	Equation:	$Act_f = Act_o \times e^{-((.693/t)T)}$
Ref. Date	15-Sep-13		
Half-life (years)	2.13E+05	7.77E+07 days (Half-life)	
Current Date	8-Jul-14	296.00 days (t)	

Corrected Surface Emission Rate =

27,870 ***particles/min***

Equations

Chi-squared Calculations $\chi 2=\Sigma(n-n)^{\wedge}2$

s_i = 2.09 counts

s_i = minimum detectable number of net source counts in scan observation interval *i*

i = scan observation interval (sec)

Minimum Detectable Count Rate (MDCR) $MDCR = s_i \times 60/i$

$s_i = d' \times SQRT(b_i)$

d' = 1.38 (source: MARSSIM Table 6.5, pg. 6-40; assumes correct decision rate of 95%)

b_i = number of background counts in scan observation interval *i*

Scan Minimum Detectable Concentration (Scan MDC) $Scan\ MDC = MDCR/(SQRT(p) \times E_T \times ACF)$

p = surveyor efficiency (source: MARSSIM Section 6.7.2.1, pg. 6-42)

Static MDC

$$MDC = \frac{3 + 3.29(R_b t_s[1 + t_s/t_b])^{1/2}}{(t_s)(E)(A)}$$

R_b = number of background counts over background count time interval t_b

t_s = sample count time interval (min)

t_b = background count time interval (min)

E = total (instrument + surface) efficiency (cpm/dpm)

A = area correction factor (i.e., detector active area divided by 100) (cm^2)

Review:

7-8-14

Technical Reviewer Date

Gilbane

SCALER INSTRUMENT SET-UP WORKSHEET

Contract Number / Task Order Number:	Project Title / Location:	ITSI Gilbane Project Number:
N62473-10-D-0808 / 0004	Parcel D1 Phase II / Hunters Point Naval Shipyard	7204.0004

Source Response: **Alpha**

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Instrument / SN: 2360/278618
Probe Type / SN: 43-93/PR311163
Technician: C. Bryson
Location: HPNS

Cal. Due: 29-Aug-14
Cal. Due: 29-Aug-14

Setup Date: 08-Jul-14
Source Cert. Date: 15-Sep-13
Source SN: K7-323
Surface Emission Rate: 23,650 particles/min
Source Type: Th-230
HV Check/Setting: 800

Background Count Time: 2 minutes
Source/Sample Count Time: 2 minutes

1. Total Background Counts observed:

Chi-squared Calculations

1	0	-0.4	0.1
2	0	-0.4	0.1
3	0	-0.4	0.1
4	2	1.7	2.7
5	0	-0.4	0.1
6	0	-0.4	0.1
7	0	-0.4	0.1
8	0	-0.4	0.1
9	1	0.7	0.4
10	0	-0.4	0.1
11	0	-0.4	0.1
12	0	-0.4	0.1
13	0	-0.4	0.1
14	0	-0.4	0.1
15	0	-0.4	0.1
16	0	-0.4	0.1
17	1	0.7	0.4
18	0	-0.4	0.1
19	2	1.7	2.7
20	1	0.7	0.4
		0	

Average Counts = 0.4 counts

Average Count Rate = 0.2 cpm

Standard Deviation = 0.7 counts

Sum of Squares = 9

Area Correction Factor (ACF) = 1.00 $100cm^2$

Scan Observation Interval = 1.00 sec

2. Total Source Counts observed:

Chi-squared Calculations

1	14,498	-79	6,225
2	14,546	-31	955
3	14,466	-111	12,299
4	14,442	-135	18,198
5	14,703	126	15,901
6	14,534	-43	1,840
7	14,459	-118	13,900
8	14,485	-92	8,446
9	14,662	85	7,242
10	14,579	2	4
11	14,816	239	57,169
12	14,911	334	111,623
13	14,327	-250	62,450
14	14,458	-119	14,137
15	14,566	-11	119
16	14,857	280	78,456
17	14,637	60	3,612
18	14,588	11	123
19	14,403	-174	30,241
20	14,601	24	581
		0	

Average Counts = 14,577 counts

Average Count Rate = 7,288 cpm

Standard Deviation = 153 counts

Sum of the Squares = 443,522

Chi-Squared Statistic = 30.43

Acceptable Ranges for Chi-x^2
8.91 to 32.85
(assumes n-1 degrees of freedom; two-tailed distribution @ 95% confidence level)

Net source cts = 14,577 counts
Std. Dev. Net = 153 counts
Net Ct. Rate = 7,288 cpm

Instrument Efficiency (E_I) = 0.3082 cpm/dpm
Surface Efficiency (E_S) = 0.2500 cpm/dpm
Total Efficiency (E_T) = 0.0770 cpm/dpm

MDCR = N/A cpm (@ 95% confidence level)

MDA Scan= **N/A** **dpm/100 cm^2**
MDA Static= **44.73** **dpm/100 cm^2**

Bkg count range 0 to 2 (2 sigma)
Source count range 14,271 to 14,882 (2 sigma)

Technical Reviewer

7-8-14
Date

Gilbane

SCALER INSTRUMENT SET-UP WORKSHEET

Contract Number / Task Order Number:	Project Title / Location:	ITSI Gilbane Project Number:
N62473-10-D-0808 / 0004	Parcel D1 Phase II / Hunters Point Naval Shipyard	7204.0004

Source Activity Correction Worksheet

Isotope	Th-230		
ID #	K7-323		
Initial Activity (dpm)	23,650	Equation:	$Act_f = Act_o \times e^{-((.693/t)T)}$
Ref. Date	15-Sep-13		
Half-life (years)	7.54E+04	2.75E+07 days (Half-life)	
Current Date	8-Jul-14	296.00 days (t)	

Corrected Surface Emission Rate =

23,650 ***particles/min***

Equations

Chi-squared Calculations $\chi 2=\Sigma(n-n)^2$

s_i = 0.07 counts

s_i = minimum detectable number of net source counts in scan observation interval *i*
i = scan observation interval (sec)

Minimum Detectable Count Rate (MDCR) $MDCR = s_i \times 60/i$

$s_i = d' \times SQRT(b_i)$

d' = 1.38 (source: MARSSIM Table 6.5, pg. 6-40; assumes correct decision rate of 95%)
b_i = number of background counts in scan observation interval *i*

Scan Minimum Detectable Concentration (Scan MDC) $Scan\ MDC = MDCR/(SQRT(p) \times E_T \times ACF)$

p = surveyor efficiency (source: MARSSIM Section 6.7.2.1, pg. 6-42)

Static MDC

$$MDC = \frac{3 + 3.29(R_b t_s[1 + t_s/t_b])^{1/2}}{(t_s)(E)(A)}$$

R_b = number of background counts over background count time interval t_b
t_s = sample count time interval (min)
t_b = background count time interval (min)
E = total (instrument + surface) efficiency (cpm/dpm)
A = area correction factor (i.e., detector active area divided by 100) (cm^2)

Review:

7-8-14

Technical Reviewer Date

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

CUSTOMER ENVIRACHEM, INC

ORDER NO 20229136/396037

Mfg	Ludlum Measurements, Inc.	Model	2360	Serial No	278618
Mfg	Ludlum Measurements, Inc.	Model	43-93	Serial No	PR311163

Cal. Date 29-Aug-13 Cal Due Date 29-Aug-14 Cal. Interval 1 Year Meterface 202-855

Check mark ✓ applies to applicable instr. and/or detector IAW mfg. spec T 73 °F RH 36 % All 701.8 mm Hg

New Instrument — Instrument Received — Within Toler. +-10% — 10-20% — Out of Tol. — Requiring Repair — Other-See comments

✓ Mechanical ck.	✓ Meter Zeroed	Background Subtract	Input Sens. Linearity
F/S Resp. ck	✓ Reset ck.	✓ Window Operation	✓ Geotropism
✓ Audio ck.	✓ Alarm Setting ck.	✓ Batt. ck, (Min. Volt) 2.2 VDC	— RS-232 Port OK

— Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. Calibrated in accordance with LMI SOP 14.9 rev 02/07/97

Instrument Volt Set 800 V

✓ HV Readout (2 points) Ref./Inst 500 / 501 V Ref./Inst 2000 / 2001 V

Firmware Version: 39010n24
Alpha Threshold: 120 mv
Beta Threshold: 3.5 mv
Beta Window: 30 mv
Overload Set to Simulate light leak.
Instrument calibrated with a 39" cable.
High voltage set with detector NOT connected.

(EEPROM Settings)
User Time 0.1
Alpha Alarm 999999
Beta Alarm: 999999
A/B Alarm: 999999
Model 2360 Date: 8/29/2013
Calibration Date Due: 8/29/2014

COMMENTS:

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT REC'D "AS FOUND READING"	INSTRUMENT METER READING*
x1000	400k cpm	405	400
x1000	100k cpm	101	100
x100	40k cpm	405	400
x100	10k cpm	101	100
x10	4k cpm	405	400
x10	1k cpm	101	100
x1	400 cpm	405	400
x1	100 cpm	101	100

*Uncertainty within ± 10% C.F. within ± 20% ALL Range(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Readout	400kcpm	40034 (0)	40034 (0)
	40kcpm	4003	4003
	4kcpm	400	400
	400cpm	40	40
	40cpm	4	4

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Log Scale			

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources: 059 280 720 734 781 1131 1616 1696 5105 5717CO 5719CO 60646 70897 73410 E551 E552 G112 M565 S-394 S-1054 T-304 T879 T10081 T10082 Y982

✓ Alpha S/N Pu239 SN:7053 ✓ Beta S/N Tc99SN:5280,SrY90SN:5281 Other

✓ m 500 S/N 190566 Oscilloscope S/N ✓ Multimeter S/N 86250390

Calibrated By: Date 29-Aug-13

Reviewed By: Date 29Aug13

AC Inst. Only — Passed Dielectric (Hi-Pot) and Continuity Test — Failed

Designer and Manufacturer
of
Scientific and Industrial
Instruments

LUDLUM MEASUREMENTS, INC.
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

Bench Test Data For Detector

Detector 43-93 Serial No. PR311163 Order # 20229136/396037

Customer ENVIRACHEM, INC

Counter 2360 Serial No. 278618 Alpha Input Sensitivity 120 mV

Count Time 1Minute Beta Input Sensitivity 3.5 mV

Other Beta Window 30 mV

Distance Source to Detector Surface

High Voltage	Background		Isotope Pu239 Size 24900dpm		Isotope Tc 99 Size 93200dpm		Isotope Sr/Y90 Size 97293dpm	
	Alpha	Beta	Alpha	Beta	Alpha	Beta	Alpha	Beta
750	2	131	4669	354	26	11361	3	20485
775	2	178	5170	332	32	14732	2	25823
800	1	237	5521	430	16	18093	4	30774
825	1	276	5570	505	23	20973	4	33633
850	2	295	5667	569	27	23433	4	33845

Gas Proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

Gas proportional detector count rate decreased ≤ 10% after 5 hour static test using 39" cable and alpha/beta counter.

Signature [signature] Date 29-Aug-13

Header 1: John Q. Public
Header 2: SN: 278618
Header 3: SN: PR311163
Header 4: Site: Bldg 1
Header 5: RM 008, S. Wall
Header 6: Comment
Location:

Calibration Due Date: 08/29/2014
Model 2360 Date: 08/29/2013
Model 2360 Time: 10:40:33 AM

Logged Samples: 0

User PC Scaler Count Time: 0.1 minutes

Alpha Ratemeter Alarm Setpoint:	999999
Beta Ratemeter Alarm Setpoint:	999999
Alpha + Beta Ratemeter Alarm Setpoint:	999999
Alpha Scaler Alarm Setpoint:	999999
Beta Scaler Alarm Setpoint:	999999
Alpha + Beta Scaler Alarm Setpoint:	999999

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

CERTIFICATE OF CALIBRATION
BETA STANDARD SOURCE

Radionuclide:	Tc-99	**Customer:**	RES, LLC
Half-life:	(2.13 ± 0.05)E+05 years	**P.O. No.:**	10557 EZIP
Catalog No.:	EAB-099-47LB	**Reference Date:**	15-Sep-13 12:00 PST
Source No.:	K7-321	**Contained Radioactivity:**	22.83 **nCi** 844.7 **Bq**

Physical Description:

A. Capsule type:	Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded Technetium metal
C. Active diameter/volume:	41 mm
D. Backing:	Stainless steel
E. Cover:	None

CAUTION!
DELICATE SURFACE
DO NOT WIPE
ACTIVE AREA

Radioimpurities:

None detected

Method of Calibration:

This source was assayed using a windowless internal gas flow proportional counter.

Uncertainty of Measurement:

A. Type A (random) uncertainty:	±	0.4	%
B. Type B (systematic) uncertainty:	±	3.0	%
C. Uncertainty in aliquot weighing:	±	0.0	%
D. Total uncertainty at the 99% confidence level:	±	3.0	%

Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a surface emission rate of 27870 β/min in 2π on 28-Aug-13.

Daniel James Van Dalsem
Quality Control

29-Aug-13
Date

EZIP Ref. No.: 1684-91

THE LEAK TEST(S) INDICATED BY THE CHECKED BOX(ES) WAS(WERE) APPLIED TO DETERMINE THE INTEGRITY OF THE SOURCE DESCRIBED ON THE FRONT SIDE. THE LEAK TESTS INDICATED BELOW WERE EITHER TAKEN DIRECTLY FROM ISO 9978:1992 OR DERIVED FROM THE LEAK TEST METHODS LISTED IN ISO 9978:1992. THE REGULATORY LIMIT FOR LEAK TEST RESULTS IS <5 nCi (185 Bq) FOR BOTH ALPHA AND BETA-GAMMA ACTIVITY. LEAK TEST RESULTS MARKED BELOW CONTAINED <5 nCi (185 Bq) OF REMOVABLE ACTIVITY UNLESS OTHERWISE STATED ON THIS CERTIFICATE.

☐ **Standard Wipe Test**

The source was wiped over its entire surface with a moistened filter paper disk. After drying, the disk was checked for activity using a scintillation detector.

☐ **Special Wipe Test**

The source was wiped over its entire surface with moistened polystyrene. The polystyrene was then dissolved in a liquid scintillation cocktail and counted in a liquid scintillation counter.

☐ **Distilled Water Soak Test**

The source was immersed in distilled water and maintained at (50 ± 5)°C for a minimum of four hours or room temperature (20 ± 5)°C for 24 hours. After removal of the source, the liquid was a) checked for activity using a liquid scintillation counter, or b) evaporated in a planchet and the residue checked for activity using a windowless proportional counter or end-window G.M. tube.

☐ **Liquid Scintillation Soak Test**

The source was immersed for a minimum of 3 hours at room temperature(20 ± 5)°C in a liquid scintillation cocktail, which does not attack the source's outer surface material. The source was stored away from light to avoid photoluminescence. The sealed source was then removed and the activity of the liquid scintillation cocktail was measured.

☐ **Gas Source Test**

The source was placed in a vacuum desiccator and maintained at a pressure of <10 mm Hg for not less than 12 hours. The activity was checked by introducing air into the desiccator and monitoring the air with an end-window G.M. tube.

☐ **Ampoule Leak Test**

The ampoule was kept in an inverted position on a filter paper disk or polystyrene wipe for a minimum of 16 hours. The wipe was then checked for activity using a scintillation detector or liquid scintillation counter.

☐ **Bubble Leak Test**

The container was pressurized to its fill pressure; then soapy water was applied over its valve and neck or, the valve and neck of the vessel were immersed in water. If no growing bubbles were observed, the container was considered leak free.

☐ **Wipe Test for Industrial Ni-63 Sources**

The sources were wipe tested by an approved sampling plan, which called for either 100% of the batch to be individually wipe tested, or, a subset thereof. The wipe test(s) used to test for removable contamination and the results of those tests are recorded on the front of this form.

☐ **Pressure Test for Triotech Kr-85 Sources**

Prior to filling the vessel with Kr-85 gas, the vessel was evacuated to <5 mm Hg, the gas manifold system shut off and the system allowed to stand for a minimum of 30 minutes. A vacuum difference not greater than the known vacuum loss of the manifold system itself signified the vessel did not leak.

☑ **Leak Test Not Applicable**

The active area of the source is uncovered or is protected by a very thin coating. Although the deposit is adherent, it is not designed or certified to pass a standard leak test. The inactive portions of the source have been checked using the standard wipe test or special wipe test depending on the nuclide.

☐ **Other Leak Test**

Eckert & Ziegler
Isotope Products

24937 Avenue Tibbitts
Valencia, California 91355

Tel 661·309·1010
Fax 661·257·8303

CERTIFICATE OF CALIBRATION
ALPHA STANDARD SOURCE

Radionuclide:	Th-230	**Customer:**	RES, LLC
Half-life:	(7.54 ± 0.03)E+04 years	**P.O. No.:**	10557 EZIP
Catalog No.:	EAB-230-47LB	**Reference Date:**	15-Sep-13 12:00 PST
Source No.:	K7-323	**Contained Radioactivity:**	21.09 **nCi** 780.3 **Bq**

Physical Description:

A. Capsule type:	Disk (47 mm OD x 0.76 mm THK)
B. Nature of active deposit:	Electrodeposited and diffusion bonded oxide
C. Active diameter/volume:	41 mm
D. Backing:	Stainless steel
E. Cover:	None

CAUTION!
DELICATE SURFACE
DO NOT WIPE
ACTIVE AREA

Radioimpurities:

None detected

Method of Calibration:

This source was assayed using a windowless internal gas flow proportional counter.

Uncertainty of Measurement:

A. Type A (random) uncertainty:	±	0.4	%
B. Type B (systematic) uncertainty:	±	3.0	%
C. Uncertainty in aliquot weighing:	±	0.0	%
D. Total uncertainty at the 99% confidence level:	±	3.0	%

Notes:

- See reverse side for leak test(s) performed on this source.
- EZIP participates in a NIST measurement assurance program to establish and maintain implicit traceability for a number of nuclides, based on the blind assay (and later NIST certification) of Standard Reference Materials (as in NRC Regulatory Guide 4.15).
- Nuclear data was taken from "Table of Radioactive Isotopes", edited by Virginia Shirley, 1986.
- This source has a working life of 2 years.
- This source had a surface emission rate of 23650 α/min in 2π on 28-Aug-13.

Daniel James Van Dalsem
Quality Control

29-Aug-13
Date

EZIP Ref. No.: 1684-91

THE LEAK TEST(S) INDICATED BY THE CHECKED BOX(ES) WAS(WERE) APPLIED TO DETERMINE THE INTEGRITY OF THE SOURCE DESCRIBED ON THE FRONT SIDE. THE LEAK TESTS INDICATED BELOW WERE EITHER TAKEN DIRECTLY FROM ISO 9978:1992 OR DERIVED FROM THE LEAK TEST METHODS LISTED IN ISO 9978:1992. THE REGULATORY LIMIT FOR LEAK TEST RESULTS IS <5 nCi (185 Bq) FOR BOTH ALPHA AND BETA-GAMMA ACTIVITY. LEAK TEST RESULTS MARKED BELOW CONTAINED <5 nCi (185 Bq) OF REMOVABLE ACTIVITY UNLESS OTHERWISE STATED ON THIS CERTIFICATE.

☐ **Standard Wipe Test**

The source was wiped over its entire surface with a moistened filter paper disk. After drying, the disk was checked for activity using a scintillation detector.

☐ **Special Wipe Test**

The source was wiped over its entire surface with moistened polystyrene. The polystyrene was then dissolved in a liquid scintillation cocktail and counted in a liquid scintillation counter.

☐ **Distilled Water Soak Test**

The source was immersed in distilled water and maintained at (50 ± 5)°C for a minimum of four hours or room temperature (20 ± 5)°C for 24 hours. After removal of the source, the liquid was a) checked for activity using a liquid scintillation counter, or b) evaporated in a planchet and the residue checked for activity using a windowless proportional counter or end-window G.M. tube.

☐ **Liquid Scintillation Soak Test**

The source was immersed for a minimum of 3 hours at room temperature(20 ± 5)°C in a liquid scintillation cocktail, which does not attack the source's outer surface material. The source was stored away from light to avoid photoluminescence. The sealed source was then removed and the activity of the liquid scintillation cocktail was measured.

☐ **Gas Source Test**

The source was placed in a vacuum desiccator and maintained at a pressure of <10 mm Hg for not less than 12 hours. The activity was checked by introducing air into the desiccator and monitoring the air with an end-window G.M. tube.

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The container was pressurized to its fill pressure; then soapy water was applied over its valve and neck or, the valve and neck of the vessel were immersed in water. If no growing bubbles were observed, the container was considered leak free.

☐ **Wipe Test for Industrial Ni-63 Sources**

The sources were wipe tested by an approved sampling plan, which called for either 100% of the batch to be individually wipe tested, or, a subset thereof. The wipe test(s) used to test for removable contamination and the results of those tests are recorded on the front of this form.

☐ **Pressure Test for Triotech Kr-85 Sources**

Prior to filling the vessel with Kr-85 gas, the vessel was evacuated to <5 mm Hg, the gas manifold system shut off and the system allowed to stand for a minimum of 30 minutes. A vacuum difference not greater than the known vacuum loss of the manifold system itself signified the vessel did not leak.

☑ **Leak Test Not Applicable**

The active area of the source is uncovered or is protected by a very thin coating. Although the deposit is adherent, it is not designed or certified to pass a standard leak test. The inactive portions of the source have been checked using the standard wipe test or special wipe test depending on the nuclide.

☐ **Other Leak Test**

2609 North River Road, Port Allen, Louisiana 70767
(800) 401-4277 -- FAX (225) 381-2996

ARS INTERNATIONAL

ARS International, LLC

Laboratory Analysis Report

ARS1-14-01921

Prepared for:

ITSI Gilbane

Ed Palser
2730 Shadelands Drive
Walnut Creek, CA 94598

epalser@gilbaneco.com

Phone: (505) 400-4076

Project Manager Review

Management Review

Notes: ARS International, LLC assumes no liability for the use or interpretation of any analytical results provided other than the cost of the analysis itself. Reproduction of this report in less than full requires the written consent of the client.

Contact Person: Questions regarding this analytical report should be addressed to:

Project Manager

ProjectManagers@amrad.com

Phone: 225.381.2991
Fax: 225.381.2996

ACLASS ACCREDITED DoD ELAP

LELAP Cert# 01949

2609 North River Road, Port Allen, Louisiana 70767
1 (800) 401-4277 FAX (225) 381-2996

ARS Sample Delivery Group: ARS1-14-01921
Client Sample ID: 04SBD-14 (B1-B4)-001
Sample Collection Date: 07/22/14
Sample Matrix: Soil/Solid/Sludge

Request or PO Number: N/A
ARS Sample ID: ARS1-14-01921-001
Date Received: 07/24/14
Report Date: 08/15/14

Analysis Description	Analysis Results	CSU +/- 2 s	MDC	DLC	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	Tracer/Chem Recovery
K-40	2.248	1.063	1.770	0.885		pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
CO-60	-0.020	0.209	0.147	0.074	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
BE-7	2.821	1.048	1.010	0.505		pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
CS-137	0.947	0.190	0.158	0.079		pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
EU-152	0.040	0.170	0.282	0.141	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
EU-154	0.000	0.095	0.159	0.080	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
TL-208	-0.057	0.146	0.180	0.090	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
PB-210	9.876	1.985	2.020	1.010		pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
BI-212	-0.228	1.880	2.180	1.090	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
PB-212	0.087	0.132	0.203	0.102	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
BI-214	0.251	2.089	1.120	0.571	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
PB-214	0.328	0.192	0.324	0.162		pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
RA-226	0.198	1.372	2.290	1.145	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
RA-228	0.031	0.325	0.588	0.294	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
PA-234	-0.608	2.604	1.360	0.680	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
TH-234	0.000	0.000	2.500	1.250	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
U-235	0.066	0.433	0.592	0.296	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
U-238	0.000	0.000	1.860	0.930	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
AM-241	-0.002	0.110	0.184	0.092	U	pCi/g	ARS-007/EPA 901.1M	07/24/14 16:05	JDT	N/A
GROSS ALPHA	24.684	6.848	4.233	2.005		pCi/g	ARS-003/EPA 900.0M	07/25/14 15:18	CB	N/A
GROSS BETA	24.345	5.913	1.855	0.909		pCi/g	ARS-003/EPA 900.0M	07/25/14 15:18	CB	N/A
PU-238	0.032	0.101	0.219	0.065	U	pCi/g	ARS-026/Eichrom ACW-03	07/29/14 15:38	JB	8%
PU-239/240	0.081	0.159	0.295	0.103	U	pCi/g	ARS-026/Eichrom ACW-03	07/29/14 15:38	JB	8%
PO-210	19.743	1.725	0.044	0.022		pCi/g	ARS-034/HASL-PO-01 RC	07/30/14 16:24	BJS	46%
SR-90	0.519	0.342	0.515	0.241		pCi/g	ARS-032/Eichrom SRW01	08/08/14 16:59	BJS	83%

NOTES:

VLM

Project Manager Review

LELAP Certificate# 01949

2609 North River Road, Port Allen, Louisiana 70767
1 (800) 401-4277 FAX (225) 381-2996

QC Results Report

Sample Delivery Group: ARS1-14-01921
Date Received: 07/24/14

Laboratory Control Sample Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (2s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	Percent Recovery (%)	LCS Acceptance Range
ARS1-B14-01743	LCS	Sr-90	20.07	3.14	0.54	19.59		pCi/g	ARS-032/EPA 905.0	8/8/14 16:59	BJS	102	75%-125%

Blank Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (2s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician
ARS1-B14-01743	MBL	Sr-90	0.17	0.31	0.52	NA	U	pCi/g	ARS-032/EPA 905.0	8/8/14 16:59	BJS

RER Duplicate Evaluation

Analysis Batch	QC Type	Analysis Description	Result 1	CSU 1 (2s)	Result 2	CSU 2 (2s)	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	RER	RER AcceptanceRange
ARS1-B14-01743	LCSD	Sr-90	20.07	3.14	18.96	2.97		pCi/g	ARS-032/EPA 905.0	8/8/14 16:59	BJS	0.18	< 1

DER Duplicate Evaluation

Analysis Batch	QC Type	Analysis Description	Result 1	CSU 1 (2s)	Result 2	CSU 2 (2s)	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	DER	DER AcceptanceRange
ARS1-B14-01743	LCSD	Sr-90	20.07	3.14	18.96	2.97		pCi/g	ARS-032/EPA 905.0	8/8/14 16:59	BJS	0.51	< 3

Project Manager Review

LELAP Certificate# 30658 NELAP Certificate # E87558

ARS INTERNATIONAL

QC Results per Analytical Batch

Analytical Batch	ARS1-B14-01589
SDG	ARS1-14-01921
Analysis	Gross Alpha/Beta (Soil, Sludge, Waste,
Analysis Test Method	ARS-003/Gas Proportional Counter
Analysis Code	GPC-A-003
Report Units	pCi/g

Acceptable QC Performance Ranges

QC Sample Type	Performance Items and Ranges		
Laboratory Control Sample	Recovery (%):	> 75	< 125
Matrix Spike	Recovery (%):	> 60	< 140
Duplicate	Replicate Error Ratio (RER):		< 1
	Duplicate Error Ratio (DER):		< 3
	Relative Percent Difference (RPD %):		≤ 25

Laboratory Control Sample

Analysis Date	07/25/14 15:18 07/25/14 15:18	Analysis Technician	AMRAD\CBAILEY AMRAD\CBAILEY			
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	Expected Value	LCS Rec (%)	MDC
ARS1-B14-01589-01	LCS	GROSS ALPHA	6.9	1.6	6.3	109	0.18
ARS1-B14-01589-01	LCS	GROSS BETA	49	11	39	125	0.20

Duplicate RER/DER/RPD

Analysis Date	07/25/14 15:18 07/25/14 15:18	Analysis Technician	AMRAD\CBAILEY AMRAD\CBAILEY			
Analyte	Result LCS	CSU LCS (2s)	Results LCSD	CSU LCSD (2s)	RER	DER	RPD
GROSS ALPHA	6.87	1.63	6.38	1.52	0.16	0.43	7.4
GROSS BETA	49.0	11.5	48.4	11.3	0.03	0.07	1.2

Method Blank

Analysis Date	07/25/14 15:18 07/25/14 15:18	Analysis Technician	AMRAD\CBAILEY AMRAD\CBAILEY			
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	MDC	Qual
ARS1-B14-01589-03	MBL	GROSS ALPHA	-0.018	0.078	0.14	U
ARS1-B14-01589-03	MBL	GROSS BETA	-0.04	0.12	0.20	U

VLM

LELAP Certificate# 01949

ARS INTERNATIONAL

QC Results per Analytical Batch

Analytical Batch	ARS1-B14-01598
SDG	ARS1-14-01921
Analysis	Plutonium Solid, Waste, Biota, Sediment,
Analysis Test Method	ARS-026/Eichrom ACW-03-15
Analysis Code	ASP-A-023
Report Units	pCi/g

Acceptable QC Performance Ranges

QC Sample Type	Performance Items and Ranges		
Laboratory Control Sample	Recovery (%):	> 75	< 125
Matrix Spike	Recovery (%):	> 60	< 140
Duplicate	Replicate Error Ratio (RER):		< 1
	Duplicate Error Ratio (DER):		< 3
	Relative Percent Difference (RPD %):		≤ 25

Laboratory Control Sample

Analysis Date: 07/29/14 15:38 | Analysis Technician: JBYRD

Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	Expected Value	LCS Rec (%)	MDC
ARS1-B14-01598-01	LCS	PU-239/240	5.10	0.71	5.36	95	0.016

Duplicate RER/DER/RPD

Analysis Date: 07/29/14 15:38 | Analysis Technician: JBYRD

Analyte	Result LCS	CSU LCS (2s)	Results LCSD	CSU LCSD (2s)	RER	DER	RPD
PU-239/240	5.10	0.71	4.87	0.68	0.17	0.46	4.6

Method Blank

Analysis Date: 07/29/14 15:38, 07/29/14 15:38 | Analysis Technician: JBYRD, JBYRD

Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	MDC	Qual
ARS1-B14-01598-03	MBL	PU-238	-0.016	0.016	0.069	U
ARS1-B14-01598-03	MBL	PU-239/240	0.000	0.028	0.069	U

VTM

LELAP Certificate# 01949

ARS INTERNATIONAL

QC Results per Analytical Batch

Analytical Batch	ARS1-B14-01573
SDG	ARS1-14-01921
Analysis	Gamma Spec (Solid)
Analysis Test Method	ARS-007/EPA 901.1M
Analysis Code	GAM-A-020
Report Units	pCi/g

Acceptable QC Performance Ranges

QC Sample Type	Performance Items and Ranges		
Laboratory Control Sample	Recovery (%):	> 75	< 125
Matrix Spike	Recovery (%):	> 60	< 140
Duplicate	Replicate Error Ratio (RER):		< 1
	Duplicate Error Ratio (DER):		< 3
	Relative Percent Difference (RPD %):		≤ 25

Laboratory Control Sample

			Analysis Date	07/24/14 13:35	Analysis Technician	BZF	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	Expected Value	LCS Rec (%)	MDC
ARS1-B14-01573-01	LCS	AM-241	48800	3900	40838	119	410
ARS1-B14-01573-01	LCS	CO-60	57500	2300	50514	114	480
ARS1-B14-01573-01	LCS	CS-137	47300	2000	40351	117	210

Duplicate RER/DER/RPD

			Analysis Date	07/24/14 14:47	Analysis Technician	BZF	
Analyte	Result LCS	CSU LCS (2s)	Results LCSD	CSU LCSD (2s)	RER	DER	RPD
AM-241	48800	3923	46700	3499	0.28	0.78	4.4
CO-60	57500	2301	53600	2151	0.87	2.40	7.0
CS-137	47300	1981	44320	1826	0.79	2.18	6.5

Method Blank

			Analysis Date	07/24/14 16:53	Analysis Technician	JDT	
Analysis Batch Sample ID	QC Type	Analyte	Results	CSU (2s)	MDC	Qual	
ARS1-B14-01573-03	MBL	AM-241	0.4	1.1	1.9	U	
ARS1-B14-01573-03	MBL	CO-60	0.59	0.94	1.6	U	
ARS1-B14-01573-03	MBL	CS-137	-0.3	5.8	1.9	U	

ARS INTERNATIONAL
2609 North River Road, Port Allen, Louisiana 70767
1 (800) 401-4277 FAX (225) 381-2996

QC Results Report

Sample Delivery Group: ARS1-14-01921
Date Received: 07/24/14

Laboratory Control Sample Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (2s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	Percent Recovery (%)	LCS Acceptance Range
ARS1-B14-01600	LCS	PO-210	6.380	0.559	0.014	6.484		pCi/L	ARS-030/Eichrom OTW-01	7/30/14 16:24	BJS	98	75%-125%

Blank Evaluation

Analysis Batch	QC Type	Analyte	Analysis Results	CSU 1 (2s)	MDC	Expected Value	Qual	Report Units	Analysis Test Method	Analysis Date/Time	Analysis Technician
ARS1-B14-01600	MBL	PO-210	0.007	0.002	0.041	NA	U	pCi/L	ARS-030/Eichrom OTW-01	7/30/14 16:24	BJS

RER Duplicate Evaluation

Analysis Batch	QC Type	Analysis Description	Result 1	CSU 1 (2s)	Result 2	CSU 2 (2s)	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	RER	RER AcceptanceRange
ARS1-B14-01600	LCSD	PO-210	6.380	0.559	5.900	0.517		pCi/L	ARS-030/Eichrom OTW-01	7/30/14 16:24	BJS	0.45	< 1

DER Duplicate Evaluation

Analysis Batch	QC Type	Analysis Description	Result 1	CSU 1 (2s)	Result 2	CSU 2 (2s)	Qual	Analysis Units	Analysis Test Method	Analysis Date/Time	Analysis Technician	DER	DER AcceptanceRange
ARS1-B14-01600	LCSD	PO-210	6.380	0.559	5.900	0.517		pCi/L	ARS-030/Eichrom OTW-01	7/30/14 16:24	BJS	1.26	< 3

Project Manager Review

LELAP Certificate# 01949 NELAP Certificate # E87558

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Notes:

Comments:

1.0) Soil and Sludge analysis are reported on a wet basis or an as received basis unless otherwise indicated.

2.0) Data in this report are within the limits of uncertainty specified in the reference method unless otherwise specified.

3.0) Modified analysis procedures are procedures that are modified to meet the certain specifications. An example may be the use of a water method to analyze a solid matrix due to the lack of an officially recognized procedure for the analysis of the solid matrix. Modified analyses are indicated by the subsequent addition of "m" to the procedure number (i.e. 900.0M).

4.0) Derived Air Concentrations and Effluent Release Concentrations are obtained from 10 CFR 20 Appendix B.

5.0) **Total activity** is actually total gamma activity and is determined utilizing the prominent gamma emitters from the naturally occurring radioactive decay chains and other prominent radioactive nuclides. Total activity may be lower than the actual total activity due to the extent of secular equilibrium achieved in the various decay chains at the time of analysis. The total activity is not representative of nuclides that emit solely alpha or beta particles.

6.0) Ra-228 is determined via secular equilibrium with its daughter, Actinium 228 (Gamma Spectroscopy only).

7.0) U-238 is determined via secular equilibrium with its daughter, Thorium 234 (Gamma Spectroscopy only).

8.0) All gamma spectroscopy was performed utilizing high purity germanium detectors (**HPGe**).

9.0) ARS makes every attempt to match sample density to calibrated density; however, in some cases, it is not practical or possible to do so and data results may be affected (Gamma Spectroscopy only).

10.0) Gamma spectroscopy results are calculated values based on the **ORTEC®** GammaVision ENV32 Analysis Engine.

Method References:

1.0) **EPA 600/4-80-032**; Prescribed Procedures for the Measurements of Radioactivity in Drinking Water, August 1980.

2.0) Standard Methods for Examination of Water and Waste Water, 18th, 1992.

3.0) **EPA SW-846**; Test Methods for Evaluating Solid Waste, Third Edition, (9/86). (Updated through 1995).

4.0) **EPA 600/4/79-020**; Methods for Chemical Analysis of Water and Waste, March 1983.

5.0) HASL 300

6.0) **ARS-040**; An LCSD is not reported with this process. The criteria for the LCS/LCSD analysis for reproducibility have not been established for Low Level Tritium analysis. A prepared standard for Low Level Tritium has not been developed. As a result, the standard we use is based on the dilution of a verified conventional tritium standard. The volume required for Low Level Tritium analysis, in addition to the lack of an available Low Level Tritium standard, introduce variability into the LCS/LCSD analysis that does not represent the actual sample analysis. The preferred measure for reproducibility is to run a duplicate analysis of a sample.

Definitions:

1.0)	**ND**	Not detected above the detection limit (non-detect).
2.0)	**MDC**	(Minimum Detectable Concentration) minimum concentration of the analyte that ARS can detect utilizing the specific analysis
3.0)	**MBL**	Method Blank
4.0)	**DO**	Duplicate Original
5.0)	**DUP**	Method Duplicate
6.0)	**MS/MSD**	Matrix Spike/Matrix Spike Duplicate
7.0)	**S**	Spike
8.0)	**RS**	Reference Spike
9.0)	***SC**	Subcontracted out to another qualified laboratory
10.0)	**NR**	Not Referenced
11.0)	**N/A**	Not Applicable
12.0)	**	False Positive due to interference from _____
13.0)	**U**	Activity is below the MDC
14.0)	**LCS/LCSD**	Laboratory Control Standard/Laboratory Control Standard Duplicate
15.0)	**DLC**	Decision Level Concentration (ANSI N42.23) or critical level

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CHAIN-OF-CUSTODY RECORD

ITSI Gilbane
Ed Palser
Walnut Creek
(505) 400-4076 EXT: epalser@itsi.com

COC # HPSD1-0147

Gilbane

Project Name: HPSD1	Laboratory: AMERICAN RADIATION SERVICES (ARS), INC., PORT ALLEN, LA
Project Number: 07204.0004	Point of contact: Please insert point of contact, insert laboratory phone number, insert e-mail
WBS Code: 0058000	Ship to: Please add laboratory address

Comments:

Equipment:

Code	Matrix
SO	SOIL

Code	Container/Preservative
	1* 250 mL plastic jar,

Event: Ship Berth Surveying

	Sample ID	Matrix	Date	Time	Samp Init.	A01RM - Solid Pu-23940	A01RM - Solid Po-210	E900 - Gross Alpha & Beta	E901.1 - Solid Ra-226 and CS-137	E905.0 - Solid Sr-90 and Sr-T	GS186 - Ra-226 and CS-137 Screening	Location ID	Sample Type	Depth (ft bgs) Top	Depth (ft bgs) Bottom
1	04SBD-14B1-001	SO	7/22/2014	0800		X	X	X	X	X	X	04SBD-14B1-001	N1	0.00	0.00
2	04SBD-14B2-001	SO	7/22/2014	0900		X	X	X	X	X	X	04SBD-14B2-001	N1	0.00	0.00
3	04SBD-14B3-001	SO	7/22/2014	0940		X	X	X	X	X	X	04SBD-14B3-001	N1	0.00	0.00
4	04SBD-14B4-001	SO	7/22/2014	0630		X	X	X	X	X	X	04SBD-14B4-001	N1	0.00	0.00
Cooler # 1		**Turnaround Time: 0 Days**													

* Composite sample as per Ed Paulser. JDT 7-24-14

Relinquished by: *(Signature)*	Date	Time
[signature]	07.23.2014	1400

Received by: *(Signature)*	Date	Time
[signature]	072314	1400

Shipping Date / Carrier / Airbill Number

Shipping Date: 7/23/2014

Receved by Laboratory: *(Signature, Date, Time)* **& condition**

[signature] 7.24.14 @ 11.04 / gd. cond.

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Response to Document Review Comments

Document Reviewed:	*DRAFT Final Status Survey of Ship Berths 14, 21, 22, and 29*, Hunters Point Naval Shipyard, San Francisco, California.	**Date of Document:**	August 2017
Project Site:	Parcel D-1, Hunters Point Naval Shipyard, San Francisco, California		

Reviewer:	**California Department of Public Health (CDPH) Comments** from Mr. Roger Lupo, via email to Ms. Juanita Bacey, Project Manager, Brownfields & Environmental Restoration, Department of Toxic Substances Control (DTSC) *(This review was performed in support of the Interagency Agreement between DTSC and CDPH.)*	**Date of Comments**	Email correspondence dated 14 November 2017

Item	Review Comment	Navy Response
1	(*CDPH General Comment #3 from R. Lupo*) Comments relate to the appendix M of this document and that portion of the report that reference the appendix M. Page 18 section 5.6: Draft Report Final Status Survey: Ship Berths 14, 21, 22m & 29 dated July 2017 indicates elevated Polonium-210 on dock bollards, by a recognized phenomenon that is readily observable. No source references given for recognized phenomenon. The Technical memorandum with a correction factor for the alpha activity found on the bollards leaves many unanswered questions. What research has identified indicating another possible source of elevated alpha activity, no source reference sited? "Building on previous studies." no specified source references to the previous studies. "Plate-out of Po-210 on outdoor metal structures as has been confirmed at other sites." What other sites? No source references given. The plate-out of Po-210 on outdoor metal structures is a recognized phenomenon that is readily observable primarily on galvanized metal surfaces of metal that is rusty, oxidized, or weathered. No source references given. Unable to validate/verify the assumptions used but not cited to explain the justification for the presence of Po-210 on the bollards at the shipyard. I was not able to validate/verify the assumptions used but not sited to generate the appendix M technical memorandum to explain the justification for the presence of Po-210 on the bollards at the shipyard.	The technical memorandum, included as Appendix M, was revised to incorporate references to the documented phenomenon of Po-210 deposition on metal surfaces observed at Rocky Flats, Mound Laboratories, and at the K-25 site in Oak Ridge. Abelquist, Eric W. Decommissioning Health Physics: A Handbook for MARSSIM Users, Second Edition. CRC Press, New York. 2014. The purpose of the technical memorandum is to document the source of elevated alpha activity (Po-210) found on shipyard bollards and its possible cause (plate-out of environmental Rn-222 progeny). This resulted in the derivation of the alpha activity correction factor (see Appendix M). There is no evidence of a connection between the elevated Po-210 and legacy Navy operations.

Response to Document Review Comments			
Document Reviewed:	*DRAFT Final Status Survey of Ship Berths 14, 21, 22, and 29*, Hunters Point Naval Shipyard, San Francisco, California.	**Date of Document:**	August 2017
Project Site:	Parcel D-1, Hunters Point Naval Shipyard, San Francisco, California		

Reviewer:	**US Environmental Protection Agency (EPA) Comments** from Ms. Lily Lee, Remedial Project Manager	**Date of Comments**	17 November 2017

Item	Review Comment	Navy Response
5	(*EPA General Comment #1*) The Draft Report Final Status Survey: Ship Berths 14, 21, 22, and 29 (the FSS) Section 5.6 (Surveys of Remaining Ship Berth Structures) does not provide sufficient justification for statements that alpha contamination of ship berth structures is not site-related. The text states that ship berth structures, such as concrete infrastructure, bollards, and cleats were surveyed and that elevated alpha activity was encountered which could not be explained by radon and was not suspected to be from contamination. However, the statement that the elevated alpha activity is not site related is not supported by the information provided in the FSS. In general, the text and appendices in the FSS do not provide adequate documentation of the activities involving radiological surveys of ship berth structures that would support a conclusion that the release criteria have been met, as follows: [see EPA General Comments 1a through 1f below]	The following information was provided in Appendix A: Plate-out of environmental Rn-222 progeny on metal surfaces is a common occurrence. Po-210 interferes with alpha measurements collected at sites containing metal surfaces, particularly on galvanized metal surfaces or metal that is rusty, oxidized, or weathered. This effect has been confirmed at several Department of Energy sites. (Ablequist, 2001) A sample of metal shavings, rust, and paint from metal surfaces with elevated alpha activity was collected to identify the source of the elevated alpha measurements collected from the Ship Berths. The sample confirmed that the majority of the alpha-emitters was Po-210. There is no link between former Navy operations and Po-210 found on the metal bollards. The Navy ceased use of Po-210 in 1970. As the half-life of Po-210 is 140 days, contamination from Navy operations could not have caused current Po-210 concentrations on metal bollards. Ra-226 contamination was not found at the Ship Berths, and therefore Po-210 would not be due to Ra-226 decay. Therefore, the Po-210 is attributed to

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Item	Review Comment	Navy Response
		naturally occurring Rn-222 progeny plate-out as has been found throughout the country.
5a	(*EPA General Comment #1a*) The text does not list the various remaining ship berth structures surveyed or provide results for each survey. Therefore, there is a large documentation gap in the FSS with respect to the activities conducted to survey structures at the Ship Berths 14, 21, 22, and 29. Additional information about the results of surveys of other Ship Berths structures should be provided and discussed in the FSS. For example, it is unclear if there are other metal structures that also had elevated alpha counts.	Two sentences were added to Section 9.5 providing additional survey detail: "*Forty-seven surveys were performed resulting in the collection of 4,732 measurements from 1,183 locations*." Also added was, "*The appendices contain the detailed surveys which document the locations where individual measurements were performed*." The results of the surveys performed on concrete infrastructure, bollards, and cleats remaining at the Parcel D-1 ship berths are summarized in Exhibits 14 through 17. The survey details are presented in Appendices C through L.
5b	(*EPA General Comment #1b*) The text states that the elevated alpha activity was found consistently on or near heavily weathered (i.e., rusted) metal surfaces. A single composite sample of metallic shavings, rust particles, and paint scraped from bollards was analyzed. The text also states that laboratory results indicated that neither Radium-226 (Ra-226) nor Plutonium-230 (Pu-239) were present and that the only alpha-emitting radionuclide detected above the Minimum Detectable Concentration (MDC) was polonium-210 (Po-210). However, only one sample was analyzed in the laboratory using gamma and alpha spectroscopy analyses. The analysis of a single metal shavings/rust particles/paint sample, using gamma spectroscopy does not provide sufficient	The conclusion that the elevated alpha measurements are due to naturally occurring plate-out of Rn-222 progeny is based on field observation and the recognized occurrence of Po-210 on rusty, oxidized or weathered metal surfaces (Ablequest, 2001). The sample of metal shavings, rust, and paint was analyzed and found Po-210 to be the primary contributor of the elevated alpha readings. Note that the sample was a composite collected from four separate locations. See response to EPA general comment 1.

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Item	Review Comment	Navy Response
	evidence to support a conclusion that the elevated alpha activity was not from Ra-226 and is not site-related. Further, the FSS did not discuss or provide information regarding the gamma and alpha spectroscopy analysis requirements or quality control parameters used to analyze the sample. Therefore, it is not clear if the analysis was representative of site conditions. For example, the FSS does not state if the sample was collected in a sealed container and counted after a 21-day in-growth time or how the analytical instrumentation was calibrated to account for the complex matrix/geometry of the sample for the gamma spectroscopy analysis. It is also unclear how the sample was prepared for the alpha spectroscopy analysis, such as whether the entire sample was digested and whether there were any interferences encountered in the alpha spectroscopy analysis that would affect or bias the results. As such, the defensibility of the analysis results and conclusions are not supported by the information provided in the FSS.	The laboratory analytical report attached to the technical memorandum provides analytical results, uncertainties, MDCs, tracer recovery percentages, as well as the results of laboratory control, blank, and duplicate sample evaluations. Analytical notes and method references are also included in the laboratory analytical report. The laboratory analysis was performed consistent with the SAP, which describes the sample preparation and analytical method used to perform the analysis.
5c	(*EPA General Comment #1c*) The text states that the Po-210 accounted for eighty percent of the gross alpha activity detected, which justified applying an eighty percent correction factor to the total removable alpha surface activity to conclude that the site meets the release criteria of less than 100 disintegrations per minute (dpm) per 100 centimeters squared (cm^2) removable alpha activity. However, because insufficient information exists to support that the laboratory result is representative of all structures and meets a defined set of analysis parameters and quality control, the conclusion regarding use of an eighty percent correction factor to justify that the site meets the release criteria for removable gross alpha activity, is not supported.	The correction factor was not applied to removable activity measurements. It was only applied to total alpha surface activity measurements of weathered outdoor metal surfaces (i.e., bollards and cleats). This limited application is consistent with the results of the composite sample of scrapings taken from several bollards. The sampling event was not intended to be representative of all structures, but only of weathered metal surfaces such as bollards and cleats. The analysis parameters and quality control are detailed in the SAP.

Response to Document Review Comments			
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Item	Review Comment	Navy Response
5d	(*EPA General Comment #1d*) Section 5.6 references a technical memorandum provided in Appendix M of the FSS that was prepared and approved by the Navy that concludes the presence of approximately 20 picoCuries per gram (pCi/g) of Po-210, a daughter product of Radon-222 (Rn-222) is due entirely to environmental/ naturally occurring radon (daughter product of Ra-226) in the environment. However, the information provided in the Appendix M memo does not present adequate evidence that Po-210 on the Ship Berth Bollards is not due in any part to Ra-226 contamination at the site. Ra-226 is a known contaminant at the Hunter's Point Naval Shipyard (HPNS), and it is documented that Ra-226 devices were used on the ships, discarded from the ships, and are present in the dredged bottoms that make up the shoreline at the HPNS obtained from the Ship Berth area. For example, it is possible that the bollards were painted originally with radium-containing paint that subsequently wore off or was removed from the bollards. Further, the Historical Radiological Assessment (HRA) indicates that Operation Crossroads ships docked at this area were contaminated and that other sources of contamination may have been present due to the NRDL operations. It is therefore unclear how the Memorandum or the FSS can conclude that elevated levels of Ra-226 in and around the Ship Berths did not contribute to the elevated levels of Po-210 present on the Ship Berth Structures.	Ra-226 contamination was not identified at the Parcel D-1 Ship Berths. The highest concentration of Ra-226 identified in the proximity to the metal surfaces was 0.843 pCi/g, which is below the HPNS remedial goals. Additionally, due to the large difference in the sample results for Ra-226 and Po-210, the two are not in secular equilibrium and therefore Po-210 could not be the result of Ra-226 decay. Additional discussion was added to Section 5.6, specifically "*The presence of Po-210 cannot be attributed to legacy Navy operations (i.e., due to Ra-226 contamination) in the absence of other alpha-emitting Ra-226 progeny that also should be present under conditions of secular equilibrium. However, its presence is not unexpected due to radon decay in the environment and its long half-life (140 days) relative to other radon progeny*."
5e	(*EPA General Comment #1e*) Since the naturally occurring background for Ra-226 in the vicinity was determined to be 0.375 pCi/g, it is not clear that sufficient naturally	In the absence of other evidence of Ra-226 contamination, the ubiquitous presence of radon gas in

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Item	Review Comment	Navy Response
	occurring Ra-226 is present to produce sufficient Rn-222 at levels that would result in removable surface contamination of approximately 20 pCi/g on the bollards and other metal surfaces, particularly given the windy conditions that are typical at Hunters Point. It appears likely that most Rn-222 would be blown away from the Ship Berths. To support the speculation that Po-210 could be due to naturally occurring Rn-222, additional investigation or sampling appears to be necessary to support the conclusions regarding the source of the elevated gross alpha/Po-210 activity.	the environment is the most feasible explanation as the feeder source of the Po-210 as has been demonstrated at other DOD and DOE facilities.
5f	(*EPA General Comment #1f*) Also, given the site history involving the use and known release of hazardous and radioactive substances at the HPNS, areas with elevated gross alpha activity above the Record of Decision (ROD) release criteria that may be related to site activities involving Radionuclides of Concern (ROCs), should be remediated. All areas within the HPNS that have metal structures that may potentially contain elevated concentrations of Po-210 (e.g., Ship Berths and other metal structures along the Parcels B and C shorelines) should be investigated for elevated radioactivity. Please revise the FSS to provide information about the surveys of other Ship Berths structures. Please also clarify if the sample was placed in a sealed container and counted after a 21-day in-growth time and discuss how the instrumentation was calibrated to account for the complex matrix/geometry of the sample for the gamma spectroscopy analysis. Please discuss how the sample was prepared for the alpha spectroscopy analysis. Please also revise the FSS to discuss the issue regarding the relationship between background	Appendix M documents the Po-210 interference of alpha readings. While other areas at HPNS likely present evidence of plate-out of Rn-222 progeny, the scope of this report is limited to Parcel D-1 ship berths. The analytical notes and method references are included in the laboratory analytical report attached to the technical memorandum in Appendix M.

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Item	Review Comment	Navy Response
	concentrations of radium-226, the concentration of Rn-222 in ambient air in the vicinity of the Ship Berths, and to provide justification for the supposition that Po-210 is due to naturally occurring Rn-222. Finally, please ensure that the potential for elevated gross alpha measurements at Ship Berths and other shoreline structures along the Parcels B and C shorelines is evaluated.	
6	(*EPA General Comment #2*) The text in Section 1.4 (Deviations from Planning Documents) states that a concrete reference area identified in the Task-Specific Plan (TSP) was not used. Instead, an area adjacent to Building 400 was used to establish a reference material background for concrete. However, the text does not state why a new reference background area for concrete was selected rather than using the one specified in the TSP. Further, the FSS indicates in Section 5.6 (Surveys of Remaining Ship Berth Structures) that multiple types of surfaces were scanned for radioactivity (i.e., bollards and cleats) with unknown composition but does not state how background locations were selected for these other structures/matrices to ensure the gross alpha/beta and gamma scans provided representative and defensible data. Please revise the FSS to explain why the reference area for concrete was changed. Also, please revise the FSS to discuss the locations of the background areas that were utilized for other surfaces and to explain how these areas were selected.	The concrete reference area near Building 400 was selected and used over Building 270 for a variety of reasons, including convenience, availability, and control. The primary reason, however, was the similarity in composition and era of construction with the Parcel D-1 ship berths. No material-specific background was established for non-concrete surfaces. The levels of background activity of other materials were not high enough to cause false positive indications of radioactive contamination. Sections 1.4 and 6.4 were revised to reflect this information. Section 3.5 identifies the area adjacent to Ship Berth 29 (i.e., the soil reference area) as the area used for the gamma walkover survey.

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Item	Review Comment	Navy Response
7	(*EPA General Comment #3*) FSS Exhibit 13, Sample Analytical Results Summary, does not provide the counting or total propagated uncertainties associated with the isotopic radionuclide results. Further, the text does not state whether any of the results had any associated qualifiers from data validation. In order to assess fully the validity and usability of the reported results, this information should be included in the FSS. For completeness and clarity, please revise the tables to include the uncertainty and revise the table and/or text to discuss whether any of the results had any associated qualifiers from the data validation.	The sample analysis error is included in the laboratory analytical reports provided in Appendices C through L. A sentence to this effect was added to Section 9.4 stating, "*The data packages include the laboratory reports showing the results and associated error for each sample analyzed.*" The following additional information was added to Section 9.6, Data Quality Assessment: "*Sample data used for project decisions were assessed for overall quality. The assessment is documented in a quality control summary report provided in Appendix O. Minor quality control deficiencies affected the data were identified. However, no significant data quality issues were noted. The data were found to be of acceptable quality and usable for their intended purposes.*"
8	(*EPA General Comment #4*) Appendix A, Final Task-Specific Plan Radiological Survey and Release of Ship Berths 14, 21, 22, and 29, Section 2.2 (Final Status Survey) states "[W]hen results indicate concentrations of Sr-90 above the release criterion, the sample will be analyzed using alpha spectroscopy for Pu-239 only. In addition, 10 percent of the samples will be randomly chosen for analysis of strontium (and Pu-239 as needed) using the above criteria. The number of samples required for analysis of strontium (and Pu-239 as needed) may be increased at the direction of RASO, based on an evaluation of the gamma spectroscopy results from	The HRA (Section 6.1.2) reports that, "*Radioactive sources, including radiography devices, were found to leak radioactivity occasionally*." The leaking source was returned to the manufacturer or disposed by regulated means. The HRA continues, "*There is historic evidence of sources being repaired, resurveyed, and placed back into service….It is reasonable to assume that any needed clean-up was performed if the leaking source caused radioactive contamination to spread beyond the source*

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	each survey unit." While it is understood that Cesium-137 (Cs-137) and Strontium-90 (Sr-90) are associated with fission of Plutonium-239 (Pu-239), the Historical Radiological Assessment indicates that Pu-239 was also obtained in pure form as sources that were used in the Naval Radiological Defense Laboratory (NRDL). Yet the text does not indicate whether any samples were analyzed by alpha spectroscopy for Pu-239 without finding exceedances of Cs-137 or Sr-90. Please revise the text in the FSS to discuss whether any samples were analyzed by alpha spectroscopy for Pu-239 without finding exceedances of Cs-137 or Sr-90.	*container because this was a common practice and necessary to eliminate future problems*." No samples were analyzed for Pu-239 where there was not a Sr-90 exceedance. This information was added to Section 5.4. One sample (04-PD-SB-CL2-014) was analyzed for Pu-239 based on a Sr-90 exceedance. The sample reported results of less than MDC for Pu-239/240.
9	(*EPA General Comment #5*) As part of this review, the EPA's Preliminary Remediation Goal (PRG) calculator was accessed to estimate the potential risk posed to a resident from any one of the survey units within the Ship Berths land area. The calculator was run by inputting the highest detections of each of the radionuclides of concern (ROCs) detected at any one of the soil survey units, or the detection limit if all results were non-detect. These values included the following: Radium-226 at 0.468 picoCuries per gram (pCi/g), which resulted from the highest detection of 0.0843 pCi/g minus the background value of 0.375 pCi/g Cesium-137 at 0.143 pCi/g (before remediation) Strontium-90 at 0.326 pCi/g Pu-239 at the detection limit of 0.036 pCi/g. The parameter inputs included the following: 1000 square meter (m^2) land area, no cover (gamma shielding), the San Francisco climate, and eliminating consideration of consumption of produce. This evaluation was conducted to determine if the highest detections of radionuclides	The elevated alpha readings are attributed to a natural phenomenon and are therefore NORM, and not from legacy Navy operations.

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	combined would result in risk greater than 1E-04. This demonstration was intended to confirm that the provisions of the National Contingency Plan (NCP) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requiring the excess lifetime cancer risk be maintained within the 10E-04 to 10E-06 range, and the stated project release criteria were met. Based on this PRG calculator run, the total risk was estimated at 3.38E-05, which falls within the range of risk reported in the FSS obtained from the RESRAD model. It is noted that this estimate of risk was based on the results of radiological surveys and soil sample analysis results for land areas only and did not consider the elevated gross alpha activity identified on ship berth bollard structures or any other structures which may also have elevated gross alpha measurements at Ship Berths 14, 21, 22, and 29.	
10	(*EPA General Comment #6*) Polonium-210 is potentially an extremely hazardous material if inhaled or ingested. Elevated activity from Polonium-210 has been found on bollards at this site. Popular media have reported about the dangers of Polonium-210, so the general public may be aware of its properties. Trespassers who enter the Hunters Point Naval Shipyard could be exposed to Polonium-210. Tina Ures (Regional Water Quality Control Board) and Juanita Bacey (Department of Toxic Substances Control) conducted a site visit and found that the location of the bollards is far away from the fenced boundary of the site, so a trespasser would need to travel a relatively large distance to reach the bollards and become exposed to the Polonium-210 on the bollards. However, given the relatively high toxicity of Polonium-210, the potential high public concern, and the relatively small scale of the bollards, it would be	The Rn-222 progeny plate-out effect is not unique to Hunters Point as similar situations were identified at Rocky Flats, Mound Laboratories and the K-25 site in Oak Ridge (Ablequest, 2001). Rusted metal surfaces throughout the Bay Area may show Po-210 deposition as has been found at other locations throughout the country. Since Po-210 on rusted metal surfaces exists from natural processes, it should be managed consistent with the presence of NORM in the environment. Further, the risk posed by Po-210 is based on ingestion. As an alpha emitter, Po-210 does not pose an external radiation hazard. As the Po-210 is plated to the surface

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	prudent to remove the bollards right away to avoid any possibility of contact by trespassers.	of the metal it is not readily removable, ingestion is unlikely. To evaluate removable activity, 1,100 smear samples were collected from the ship berth bollards, cleats, and other hard surfaces. None of the smear samples reported removable activity above the project criteria.

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